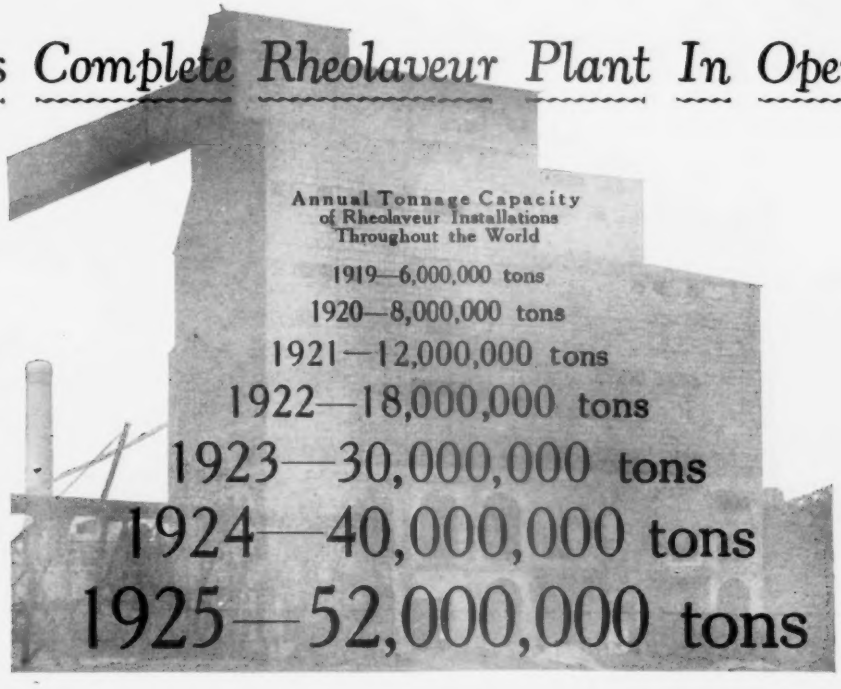
The MINING CONGRESS JOURNAL

Volume 12 OCTOBER, 1926 *Number 10*

MAMMOTH
ANTHRACITE BREAKER

Puts Complete Rheolaveur Plant In Operation



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WILKES-BARRE OFFICE
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Loomis Breaker, Glen Alden Coal Co., Capacity, 6,000 Tons per day

JOHN W. SHEERES

KNOX

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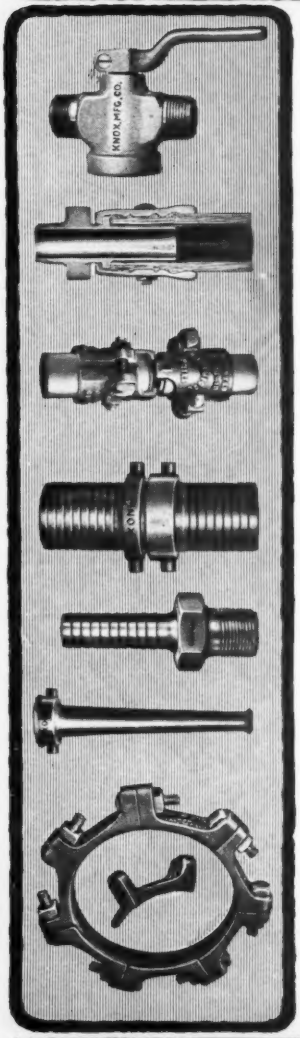
MINING SPECIALTIES

The World's Standard



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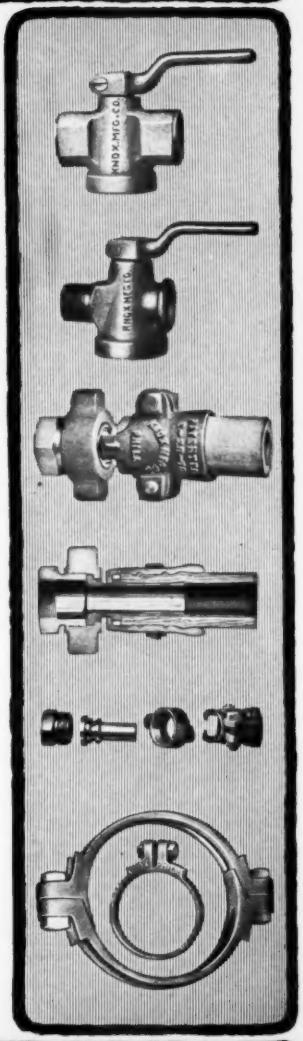
An organization which considers itself a part of every mining company in existence.

A division, as it were, of YOUR company supplying standard Throttle Valves, Hose Connections and Special Parts in close co-operation with your requirements.

Service, Material and Prices are governed by this attitude.

We want you to consider "KNOX" as the natural source of supply for Throttle Valves and Hose Connections, and when you place your next order with us do so with the feeling that you are requisitioning material from the Consolidated Warehouse of the Mining Industry.



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INCORPORATED 1911

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THE MINING CONGRESS JOURNAL

OCTOBER, 1926 CONTENTS $3 00 Per Year 30c Per Copy

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PRACTICAL OPERATING MEN'S DEPARTMENT

METALS

Flotation of Lead Carbonate Ores of the Warren Mining District, Bisbee, Arizona

Heap Leaching Sacramento Hill Low Grade Oil

COAL

Occurrence of Fire Damp in Bituminous Coal Mines

Roof Control With Underground Conveyors

Published Every Month by the American Mining Congress, Washington, D. C.

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A COMPLETE LINE FOR CUTTING, LOADING, HANDLING & VENTILATING

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If a saving of 25 to 60 cents per ton from face to mine cars interests you, a study of the next three pages will prove profitable.

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JEFFREY
COAL MINE EQUIPMENT

Jeffrey-Standard Coal Mine Equipment
Coal Cutters
Combination Cutter and Loader
Drills
Conveyor-Loader
Sectional Conveyor
Pit Car Loaders
Locomotives
Mine Fans
Tipple Equipment
Crushers

Jeffrey Concentrated

The Shortwaloader

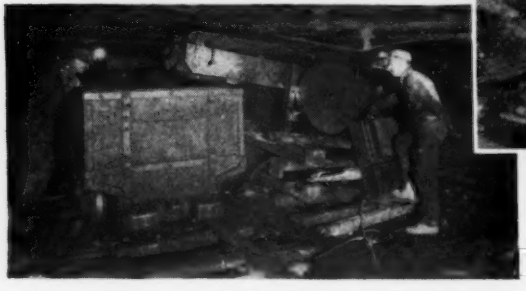
Shortwaloader with three bars swung in place for loading coal across the face.

Cuts, loads, and conveys. Stays continuously in room or entry until worked out. Reduces the number of working places in a ratio of 10 to 1. In addition to saving labor, a tremendous saving in mine equipment can be made. A reduction of 40 to 60 cents on the cost of each ton of coal mined is the record of the Jeffrey Shortwaloader.

The Sectional Conveyor

Sectional Conveyor receiving coal from Shortwaloader

Sectional Conveyor working in a room. A Jeffrey Blower with flexible canvas tubing is used to carry air to the face.



Sectional Conveyor discharging to mine car.

JEFFREY

Mining Equipment

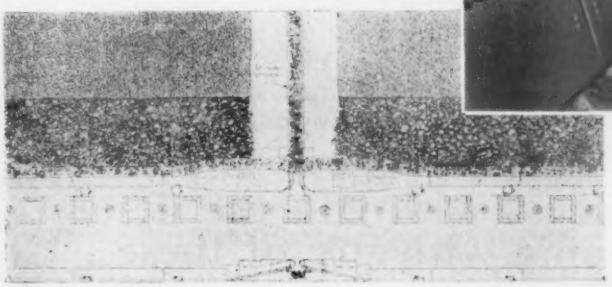
With concentrated mining, the old method of supplying cars to rooms intermittently is no longer adequate.

The Jeffrey Sectional Conveyor provides an efficient method of carrying coal from the Shortwaloader to the entry where it discharges to waiting mine cars. The sections are made in 6 ft. lengths to follow the steady advance of the mining machine.

The Sectional Conveyor performs a like service in long face mining where it receives the coal from the Conveyor-Loader described below.

The Conveyor-Loader

For loading coal in long face mining. A 100 ft. face can be loaded out twice in 8 hours. The crew will do their own cutting, shooting, loading, timbering, etc. Reduces the number of working places in a ratio of 15 to 1. Cutting and loading costs are reduced 1/3 or more.



As shown in the drawing at the left the Conveyor-Loader can be assembled both right and left hand to bring coal from opposite sides to a single central (sectional) conveyor which discharges into the mine cars.

The Transfer Conveyor

A portable conveyor designed especially for transferring coal from Sectional Conveyor to cars when the Sectional Conveyor is laid parallel to track where an entry is being driven by the Jeffrey Shortwaloader.

Other types of these portable conveyors are used between Shortwaloader and Sectional Conveyor when drawing a rib or working in wide rooms.

Coal Mine EQUIPMENT

A COMPLETE LINE FOR CUTTING, LOADING, HANDLING & VENTILATING

The Pit Car Loader

The Jeffrey 38-B Pit Car Loader is well fitted for use in rooms where, for example, the delays due to taking down top rock, etc., make the use of a more complete system of loading machines and conveyors impractical. A man can load three times as much coal with this machine as by shoveling direct to cars, effecting a saving of from 20 to 30 cents a ton on handling costs.

We will be glad to discuss with you the details of the cost of mining with any of these equipments and the possibilities that might be revealed by an analysis of costs in your mine.

You will put yourself under no obligation if you tell us you are interested.

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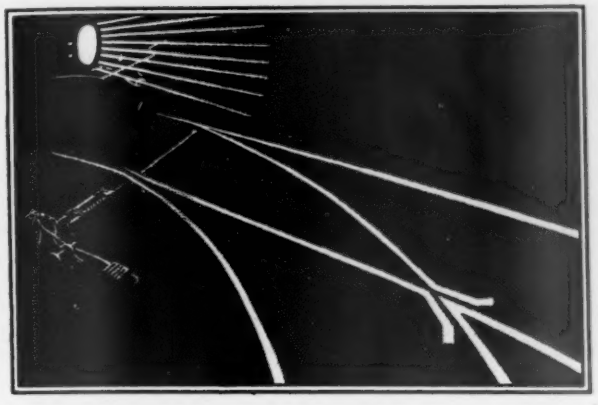
JEFFREY
COAL MINE EQUIPMENT

Jeffrey-Standard Coal Mine Equipment
Coal Cutters
Combination Cutter and Loader
Drills
Conveyor-Loader
Sectional Conveyor
Pit Car Loaders
Locomotives
Mine Fans
Tipple Equipment
Crushers

SIX MAJOR BENEFITS of Properly Planned TRACK SYSTEMS



Proper planning of track systems brings six great benefits: safety; greater speed of haulage; better car distribution; less rolling equipment required; derailments, and other costly delays eliminated; replacements and shifting of track facilitated.

Safety should always be paramount and can be secured through proper planning and good materials. *Speed of haulage* is the point back of all improvements in mine transportation and is the result, again, of good equipment properly used. *Better distribution* of cars is another result. Cars are supplied more readily where and when needed. This makes possible a *reduction in rolling equipment.* And when track material is well designed, properly made and laid out in a system that meets local conditions *derailments* as well as other costly delays are reduced to a minimum. Standardization *facilitates replacements,* reduces the track man's labor and enables him to shift tracks readily when necessary.

CENTRAL Engineers have made it their business to bring these results to the mines where they have been privileged to plan or to cooperate on the mine layout. Economy and speed of haulage with increased safety have been the satisfying results—and they may be secured for any mine. Consult with us about your problems or let us send you our catalog No. 3 of our line of equipment.

The Central Frog & Switch Co.

CINCINNATI, OHIO

CENTRAL

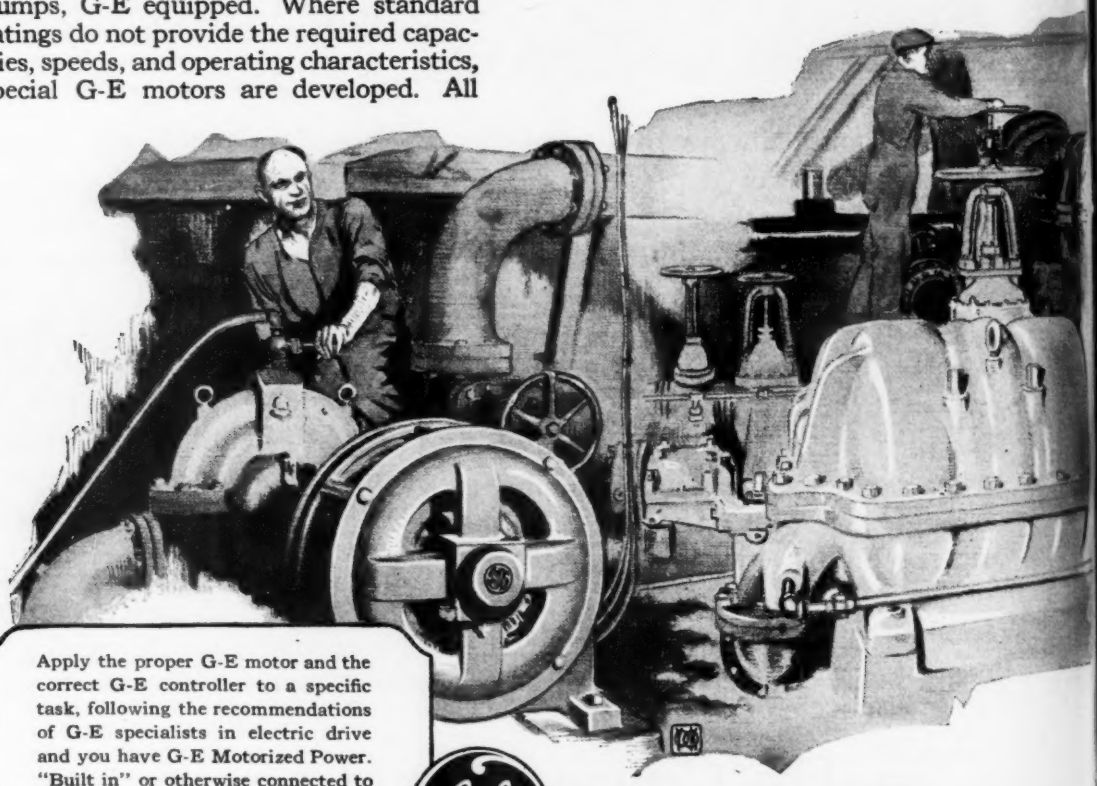
MINE TRACK EQUIPMENT

Pumping-
From Mine Sump to Hilltop

In an industry which must combat water at great mine depths, yet use it in mills and villages at the hilltops of metal mining operations, it is a tribute to G-E design and application that so many pumps in this service are equipped with G-E Motorized Power.

Standard G-E motors are used extensively for pump applications throughout the mining industry—and G-E control, both automatic and manual, contributes to the many satisfactory installations of electric pumps, G-E equipped. Where standard ratings do not provide the required capacities, speeds, and operating characteristics, special G-E motors are developed. All G-E pump motors have high-grade, moisture-resisting insulation, but where excessive moisture is encountered, special insulation is furnished.

The cooperation of G-E engineers with leading pump manufacturers provides G-E motors and control for centrifugal, reciprocating, and rotary pumps. Careful attention to your needs for improving pumping operations will be shown you at your nearest G-E office.



Apply the proper G-E motor and the correct G-E controller to a specific task, following the recommendations of G-E specialists in electric drive and you have G-E Motorized Power. "Built in" or otherwise connected to all types of industrial machines, G-E Motorized Power provides lasting assurance that you have purchased the best.

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—fitted to every need

GENERAL

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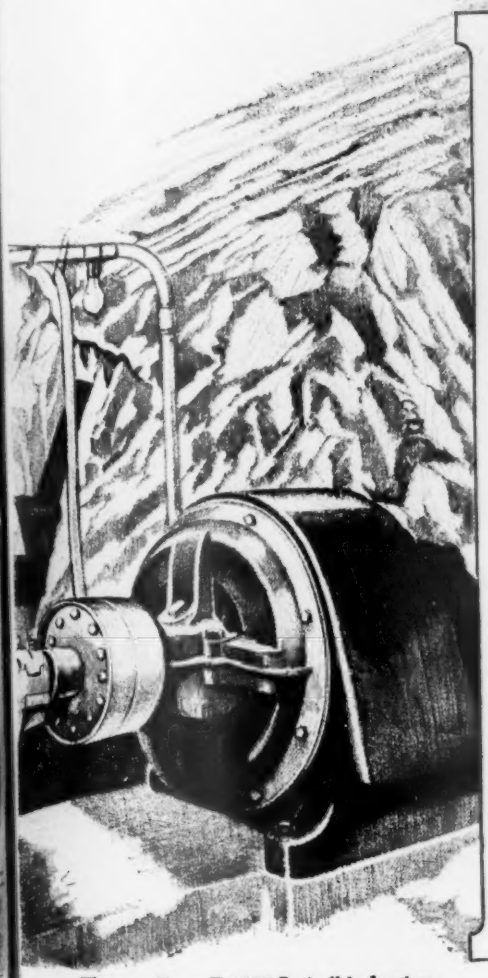
Whatever the need, G-E meets it so dependably and economically that each General Electric installation recommends another.



The new Form E "500 Series" induction motors for direct connection have closed frames with drip-shedding ventilation outlets. This construction is especially suitable for high-speed pumps and is characterized by heavy shafts, oversized bearings (split on coupling end) and large capacity oil wells.

200-27

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"Leyner-Ingersoll" R-72 Drifter and "Jackhamer" Drills driving a large railroad tunnel through a mountain

REQUEST BULLETINS
4062—R-72 DRIFTER
4046—"JACKHAMER"

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Contract work, whether tunnelling or mining, demands a Rock Drill that is dependable—one that can be counted upon to stay on the job throughout the shift. High drilling speed and durability are essential to the success of the job.

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In driving headings, the "Leyner-Ingersoll" R-72 Drifter has proved its leadership in drilling speed, durability, ease of operation and economical performance.

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is used where equipment is purchased on the basis of lowest ultimate cost over a long period of years. It is constructed to withstand the strains, abrasion and sudden pulls to which mine ropes are subjected and is the choice of particular engineers because of its dependability. There is a Roebling Rope for every purpose.

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Trenton, New Jersey

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These distinctive features assure long life, safety, power and easy operation to the Vulcan Storage Battery Locomotive.

Equalizing Levers

By means of equalizing levers, links and bell cranks the inner ends of the springs are connected. Thus the same equalization of pressure on the journals, as secured for the Vulcan Trolley and Steam Locomotives, has been made possible for the Vulcan Storage Battery Locomotive.

Worm-Gear Drive

By means of a segmented shaft, flexible couplings and worm gearing, motion is transmitted from the single motor to the driving axles. Thus is utilized a type of drive the utility of which has been proven in motor trucks, tractors, etc.

Self-Locking Brake

A quick-acting, self-locking brake, similar to that of the Ford automobile, makes sudden stops a simple operation for the driver. Throwing a lever, which actuates a cam, through a half circle, applies or releases the brake.

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Maximum strength, minimum weight and ample ventilation are secured by the cast-steel bar frames on each side of the body.

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Locomotives,
Steam, Gasoline, Electric
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Braked as easily as a "flivver"!

Just throw the lever and this locomotive is stopped. The brake works like that of a Ford car. The lever operates on a cam applying the brake. Perfectly simple, easily applied, always dependable.

And it runs as smoothly and easily as the smoothest running motor trucks. The worm gear drive makes this possible. This drive transmits power from the single driving motor to the driving axles. Chains and sprockets are eliminated and a great reduction of wear and tear on the driving mechanism results. Time wasted while the machine is laid up for repairs is as much an expense as actual parts. Consequently this worm-gear driving mechanism will render a material saving in maintenance costs.

Look over the other features listed on this page and send for the complete story.

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Air Lines from Condensers
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Drinking Water, Etc., Etc.

*Consulting Engineers
Sanderson & Porter
New York City

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for Better Health and Longer Life

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In their efforts to make this plant one of the most efficient in the country, the engineers* did not overlook the importance of good pipe in securing low maintenance cost and absence of shut-downs.

Thus, Byers Pipe of genuine wrought iron was specified and installed for a wide variety of services where corrosion has to be reckoned with and where failures are likely to be expensive.

To choose materials with a proper regard for the service they are to perform is, of course, one of the fundamentals of good engineering. The selection of pipe materials involves an appreciation of differences in corrosive conditions existing in various lines. Thus, wrought iron, with its long record of durability, enters into the calculations of every good engineer, realizing that it fills, at a relatively low cost, the need for a material of dependable physical properties and high rust resistance.

In addition to these properties, Byers Pipe is noted for its good threading qualities; it is now also being successfully Van-Stoned, a fact which adds greatly to its range of usefulness.

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Ask for Bulletin No. 38
"The Installations Cost of Pipe"
Free on Request

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Established 1864 **Pittsburgh, Pa.**
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Los Angeles Cleveland Cincinnati
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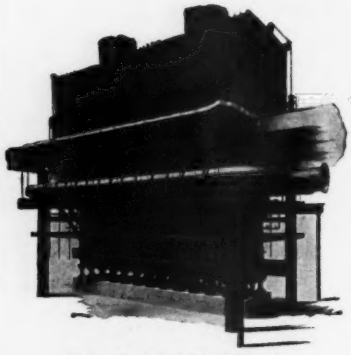
MACHINERY

—FOR—

MINE———MILL———SMELTER

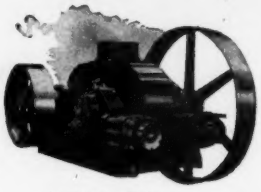
Embodying Recent Developments and Latest Design



Water Jacketed Blast Furnace

Ball Peb Granulator

Rod Mill



Crushing Rolls

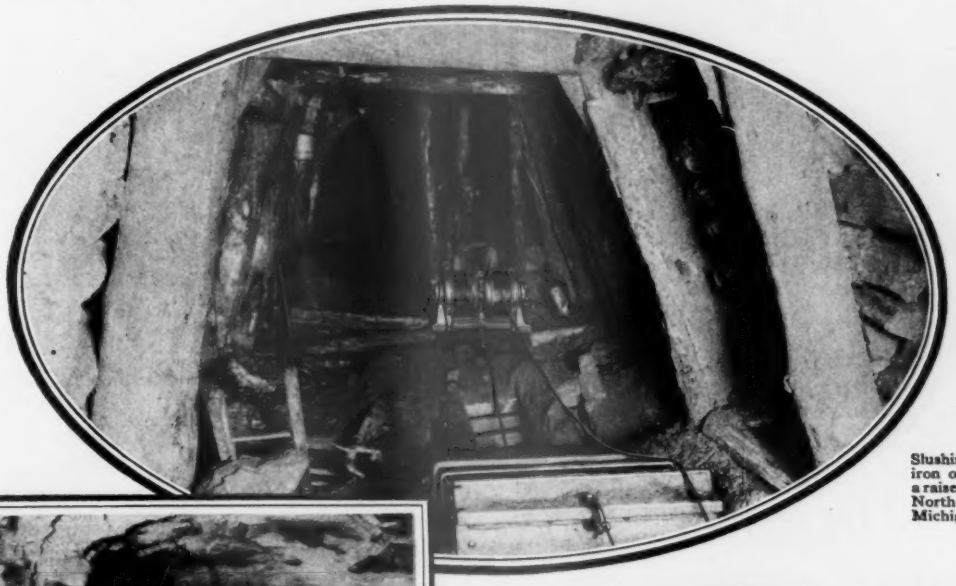
Ball Granulator

Double Drum Electric Hoist

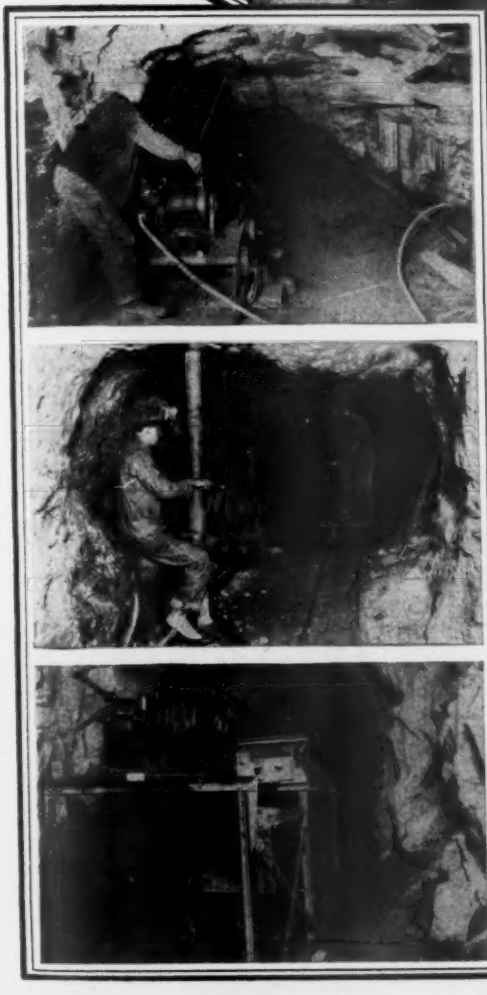
ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

SULLIVAN HOISTS LOWER MINING COSTS



Slushing iron ore to a raise, Northern Michigan



Mining uses for Sullivan Turbinair Hoists are legion

"The handiest tool on the job"—that is how mine men speak of the Sullivan Portable Hoist. These hoists are built in several types and for electric, steam, or air power.

The uses of these Sullivan Hoists cover all the smaller hoisting jobs in and around the mine or on the surface. For "slushing" they cut the cost of hand mucking in two. They can be used for hauling loaded cars, thus saving the time of haulage locomotives. They can be used in sinking winzes or for scraping into raises in sub-level stoping.

These are only a few of the scores of labor-saving tasks that can be quickly and cheaply done with Sullivan Hoists.

In coal mines, there are still other special uses which reduce operating costs.

These Sullivan Hoists will lift a ton on a single line at 110 *feet per minute, or will pull a* 100,000-*lb. freight car on level track.*

Turbinair Hoists, Bulletin 3776-F
Electric Hoists, Bulletin 3775-G

Above: Lowering timbers in an anthracite mine, Scranton, Pa.
Center: Pulling a loaded can up a slope, Joplin District, Mo.
Below: Turbinair Slusher on a loading slide in a rock drift, Butte

SULLIVAN MACHINERY COMPANY
148 SOUTH MICHIGAN AVE., CHICAGO, ILLINOIS U.S.A.

Insures greater tonnage in marketable sizes

THERE'S a grade of Coalite—the Atlas permissible explosive—to meet every blasting problem encountered in mining coal. The use of the right grade means greater tonnage in marketable sizes at a lower cost. You can improve your blasting results by using the grade of Coalite that is fitted to your particular work. Let the Atlas Service Man help you determine it. Write nearest branch.

COALITE

The permissible explosive
packed in white paper cartridges

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WILMINGTON, DELAWARE

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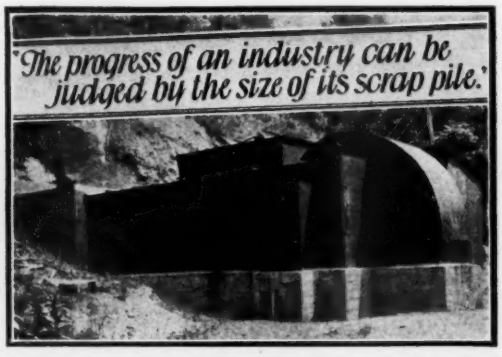

Mr. Samuel Insull

President Commonwealth Edison Co.

says:

"OUR 'scrap pile policy' . . . is a matter of discarding the old and adopting the new, in machinery or in methods, the moment we are assured of a gain in efficiency or economy. . . . The most valuable asset of the lighting and power industry is the junk pile."

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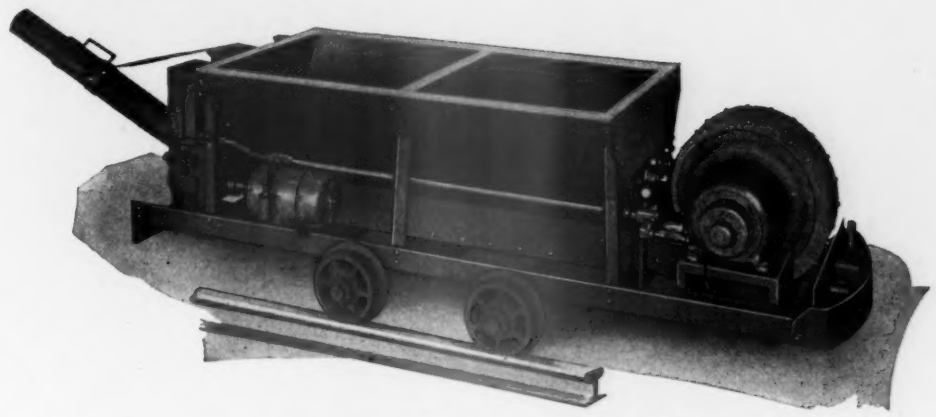

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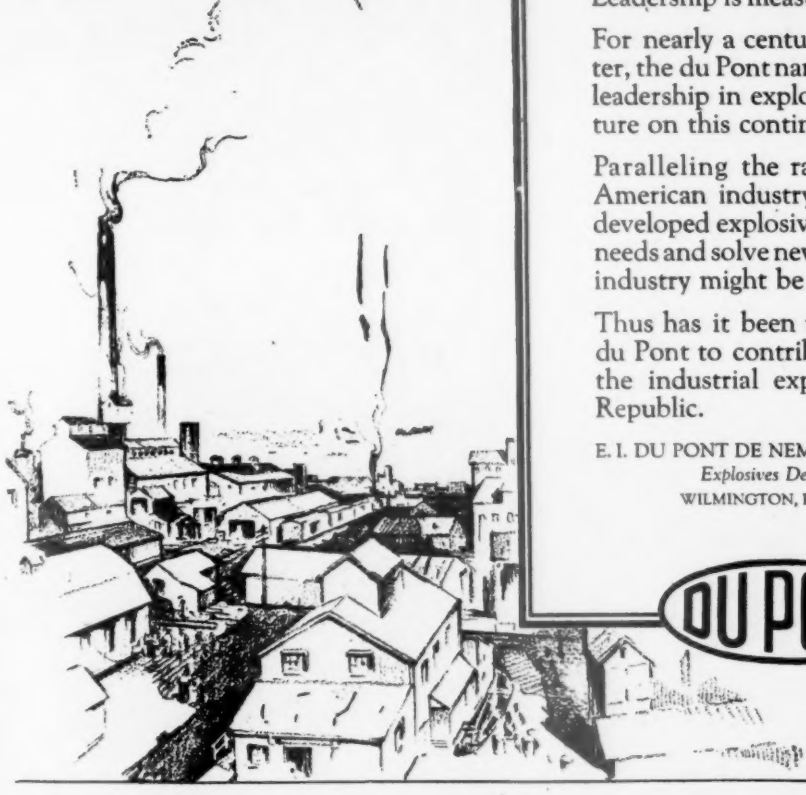

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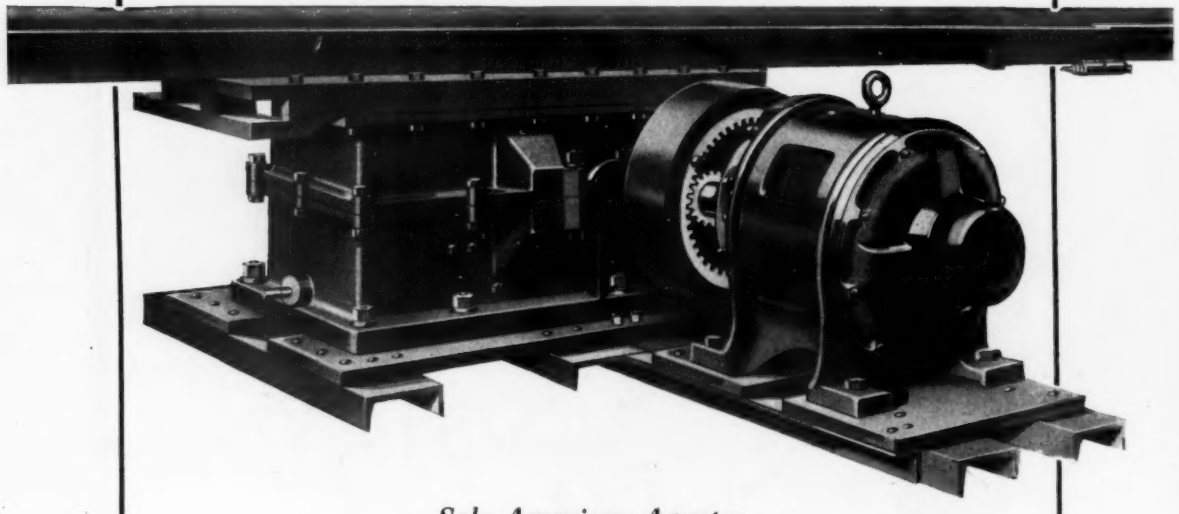

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THE TRAGEDY OF FOOLISH STATESMANSHIP

THOSE who are directly interested in silver in the Americas are startled by the contents of the report of the Royal Commission on Indian Currency and Finance.

It is proposed to drive India to an alleged gold basis, under the provisions of which, the use of silver coin is to be discouraged and paper money to be substituted therefor. During a period of ten years, the 700 million ounces of silver in the coinage surplus of India is to be sold in an unwilling market and the two to four billions of hoarded silver which constitute the chief wealth of India's people is to be reduced in value as the market price of silver is forced to panic prices upon an unwanted product.

If this were to be done by an alien enemy, the world would stand aghast because of its brutality.

The proposals of the Commission contemplates:

1. The destruction of the convertibility of paper rupees into silver rupees.
2. The encouragement of the use of paper rupees in place of silver rupees.
3. The converting of the present holdings of silver in India into gold bars or more economic forms of savings.
4. That the Indian Government shall cease the purchase of silver for coining into rupees and, during a period of ten years sell the greater part of their present stock of silver.

In carrying out the plan, it is recommended that paper currency shall cease to be convertible by law into silver coin, this apparently to stabilize the value of the paper currency which has heretofore followed the fluctuations in the price of silver. The stabilization of the rupee currency at 36 cents is recommended, on the ground that internal prices are generally adjusted to that valuation.

From information at hand, the two main purposes of the Commission's recommendations look first to the stabilization of the currency of India, by the adoption of gold as the basis of values and, second, to force the wealth of India into banks and thus make available for business purposes the silver wealth which is now hoarded.

The major part of the accumulations of the people of India is silver, in coins, ornaments and jewelry. To stabilize the value of these accumulations by throwing upon the world's markets the greater part of the Government stock of silver and thus wrecking the market, would seem to look toward the very opposite from the result sought; it would seem to threaten a catastrophe to the Indian people, in comparison with which the loss to silver producers will be infinitesimal.

The proposal to adopt a gold bullion standard of values, with the use of paper rupees and the discouragement of the use of silver rupees will, if carried out, add to the burdens of gold as the general standard of values throughout the world. It will be a severe blow to the silver producers of the United States; but, on the other hand, will add enormously to the buying power of that nation, which now controls the greater part of the world's gold stocks and has power to largely increase its production of gold.

To bring greater prosperity to one industry at the sacrifice of another is not for the permanent advantage of the country containing the two industries. To bring prosperity to one country at the sacrifice of another country is not for the permanent advantage of the world. We have always contended and frequently pointed out that the total world stocks of gold and silver are not more than enough to meet the requirements of currency systems sufficient to meet its business requirements.

We have contended that, while the gold standard of values must prevail, that the use of silver as subsidiary coinage, based on the gold standard is and will remain a necessity and that, without such use, the business prosperity of the world can not be maintained.

The weak link is the constantly fluctuating price of silver, a condition caused more by psychologic conditions than by supply and demand. No greater service can be rendered to the whole world and, in the end, to every part of the civilized world than that the silver producers of the American continents should stabilize the price of silver. This is not an easy task, but it can be done. The effort required is justified by the great benefit to be accomplished; it is justified by the most selfish and by the most generous of motives. The intelligent selfishness of the nation and its most altruistic desire to help the world at large, can both secure most complete reward, by securing to the world an ample supply of circulating medium in which the world has confidence. This can not be secured by the use of gold alone. It can only be accomplished by the use of both metals which, in turn, requires that the values of neither shall be subject to violent fluctuations. The rise or fall of either as a money metal is equally disastrous. The sacrifice of silver and the appreciation of gold values are coincident. Stabilization of exchange units is essential to prosperity. Gold can not carry the world's burden without a rise in value that spells disaster. The stabilization of world commerce requires the use of silver freed from the fluctuations of value, occasioned by the caprice of defective vision.

The silver producers of the western continent owe a supreme duty to the world. Will they undertake it?

SOUGHT BUT NOT DESIRED

THE more we come to understand the real issues in the British coal strike, the more clear it becomes that the miners and others are seeking a familiar but an undesirable goal. What they really want is some method by which unequal conditions in dissimilar coal fields can be equalized. A device which would do that same thing has been sought patiently by many through the years. It has never been found. It is a question whether it should be found or whether, if found, it should be used.

The one point about British coal mining upon which all observers seem to have reached common ground is that the coal mines of Great Britain may, broadly, be classified into three major groups. In one of these groups working conditions, et cetera, are quite favorable, thus giving prospects of profit even with high wages and low prices. A second group, under identical conditions, can about break even. A third group is facing a loss before it ever turns a wheel. Starting with those known facts, three proposals have been presented to the English people for discussion and decision. That of the miners is that the mines in the third classification shall pay a living wage. This would allow the miners employed by the other two groups to make a handsome wage. The resultant high price of coal would have to be equalized by some device.

The second proposal—that of the coal owners—is that wage settlements shall be by districts. This would allow each district to pay such wages and to concede such working conditions as it could afford. This would put the less favored districts under necessity to work out some better plan of operation if they hoped to overcome their handicaps. The third proposal is that the mines should be consolidated and that the strong mines should carry the weak—closing the poor mines for long periods and only bringing them into production as a factor of safety or to meet some sudden and pressing demand.

There is a fourth suggestion to which no serious attention has been given. It is that the poorer mines should be abandoned and only reopened to salvage the coal at the end of some long period or after the mines which are more easily worked should have become exhausted. That proposal lacks any appeal to either the imagination or the common sense of the Anglo-Saxon.

That by which we are confronted is, therefore, a proposal that the dissimilar conditions found in mining shall be equalized by some artificial control of either wages or prices. It is open on its face to the objection that economic forces have a way of resisting control. Therefore, the plan is unworkable. But it is open to a far more serious objection, which applies whether the situation develops in Great Britain or in the United States.

We had, in the metal mining industry in the West a similar situation some years ago. Side by side—often on the same property—it was necessary to work out a rich lens of ore and a complex ore which, relatively, was lean. It was a question whether the rich ore should carry the lean or whether the lean ore should be left for treatment after the richer veins had been worked out. Neither proposed solution appealed to the common sense of the gentlemen who controlled the ore bodies. They said that sooner or later the rich ores would be gone. At that time nothing would be left but the lean ores. At such a time they would, without experience, be compelled to treat the lean ores and thus would come to an abrupt change in mining costs and in the necessary price of the resulting metals. It did not appeal to these gentlemen as a wise thing to rush into such a dangerous position. Therefore, they learned to work out the lean ores while the richer lenses were still available and were offering a competitive influence.

Much the same question has, on many occasions, been introduced into the discussion of the affairs of the anthracite industry. In that field there are thick veins which lie flat and are easily worked; there are thin veins which are pitching, thus making recovery difficult. It might have been that the thick veins could have been worked out first. The operators were unwilling to risk it. Therefore, they learned to work out the thin veins while they still had some of the thick coal left. This same situation runs all through mining.

On many an occasion an effort—sometimes participated in even by the Government—has been made to equalize conditions among dissimilar railroads.

Thus, over and over again, we have been confronted, in this country, by the very situation which is now the most bothersome factor in the British situation. Our experience has been that it is difficult to effect this equalization—almost impossible, in fact. But, of far greater importance, we have found that most of our real economic progress has come from mastering the problems of the difficult situations, rather than from taking the easy money which springs from development of properties which present no difficulties.

The vital point for consideration in all such matters, where they touch mining operations, is that the bonanza mines and veins are, under our intensive use of natural resources, disappearing with amazing rapidity. The time is approaching when we will have left only those mines which we now find it difficult to work. It would be a fatal blunder, from an economic point of view, if we were to leave, until we had to work them, a study of the best methods of recovery of those difficult seams.

It is pertinent that the coal owners of Great Britain have, evidently, seen this point. They have, therefore, said that each district should pay what it can afford. That system, if followed, would put the third district, in question, under the need to improve its methods if it wanted to live. And, as it found a way to live, it would find a way to solve the vexing problems of the near future.

THE GOVERNMENT'S FINANCES AND BUSINESS

REPORTS made at the close of the Government's fiscal year and since show results that justify a feeling of satisfaction. Prosperity continues in most of the important industries and does not appear to be threatened by any serious menace. The mining industry is sharing in this prosperity, and is on the road to sustained improvement, except in the case of bituminous coal. And even in that branch of the mining industry the spirit of cooperation is pointing to better conditions.

During the fiscal year which ended July 1, the public debt was reduced by $870,000,000, a reduction of $35,000,000 more than last year. And the Government's balance sheet showed a large surplus in revenues over expenses. This is concrete evidence of efficient management of the Government's finances. Government expenses are being reduced still further, and the economies effected, together with increased revenue collections, indicate that a surplus of a half billion dollars will be accumulated during the current fiscal year.

The effect upon the country has been good; wages have been high; there has been little unemployment; credit conditions have been favorable; the consuming power of the Nation has been constantly growing; and, in general, all industrial lines have enjoyed a period of

increasing activity and sustained prosperity, the continuation of which is not likely to be seriously disturbed by any condition that now appears on the horizon of the future. Even in agriculture, where there has been so much complaint, the outlook is promising.

Credit for this national situation should justly be given to a sane administration, and all those in it who are responsible for the management of governmental affairs. Political party lines should be erased in meting out the praise that is justly due President Coolidge's economy program, Secretary Mellon's plan for eliminating uneconomic taxes and curtailing the public debt, and Secretary Hoover's policies for handling the problems of our domestic and foreign commerce.

An interesting feature of our present prosperity is the fact that per capita production has increased. We have long maintained that the sooner the workers of the Nation shall come to a realization that what they earn must come out of what they produce, the sooner will stabilized industry become a fact and sustained prosperity a certainty.

APPROACHING THE TRUTH

IN the last quarter of 1925, two enterprising engineers of Great Britain decided to make a tour of the United States to discover, if possible, how the American business man can pay high wages and still sell his goods at low prices. They wanted to know what gave America its advantage over Great Britain. These two gentlemen published a report of their individual findings. Shortly thereafter the British Premier, Mr. Baldwin, made a speech in which he suggested that it might be well for the British industry to make an inquiry in America along this same line. This suggestion was seized instantly by one of the most progressive of the London papers, the London Daily Mail, which decided to send a delegation from the engineering crafts to the United States to study this same question. This commission has published its report.

These two documents are a trifle too enthusiastic about America and a little too severe on Great Britain to be of real value to the student. Still, they do serve to draw a lesson of first importance to the mining industry—especially coal—in the United States. They both emphasize the fact that the real secret of business success in the United States is the use of labor-aiding machinery. The true explanation of the British difficulty is that the workers resist the use of such labor-aiding machinery and the managers of British business have not been aggressive in pressing these devices upon their employes.

The authors of these two documents have hit upon one distinction which is vital. They point out that in both England and the United States unfortunate phrasing has been employed to describe these valuable devices. In both countries they have been styled "labor-*saving*" machines. This has resulted in a certain amount of resistance to their use because labor has said that the intention was to supplant workers by machinery. The authors of both reports have pointed out that the real purpose of these machines is to *aid* the workers—not to supplant them. Therefore, both reports have employed the same phrasing—"*trouble*-saving" machinery. That phrasing comes nearer to expressing the true purpose of such machines but it is not quite right. It would seem that "labor-*aiding*" machinery would be a more nearly correct designation.

After all, the real point is that by the use of this machinery, in other industries, America has clearly gone ahead of England. And, England now realizes that it can not hope to compete unless it does what America is doing. The big point Great Britain's students develop is that by the use of this machinery alone is it possible for the producer concurrently to increase his wages and reduce the selling price of the goods. The British see that this is a double advantage to the worker—it increases his pay and increases the buying power of his money.

The very difficulty which Great Britain now recognizes as limiting its own progress has been holding back the mining industry in the United States. Miners have been told—and believe—that labor-*aiding* machinery is, in reality, labor supplanting machinery. They believe that the use of these machines would throw men out of employment, with no prospects in any other directions. Therefore, in our mining industry, the miners have offered a steady resistance to the use of these machines. On the other side of the question, the operators have been slow to force the issue because to do so promised to involve them in a complicated quarrel with the unions, which is destructive and hence costly. On these accounts the American mining industry has hardly made that use of machinery which has proved the salvation of every other American business. For this reason the American mining industry is more nearly on the English than on the American basis of efficiency.

With this question raised and clarified by the British themselves, renewed impetus is given to the study of complete mechanization of the American mines. And, since the British have pointed the way, it will be easy to make it clear to our own mine workers that by this process alone can the operators hope to advance wages while concurrently reducing their selling prices. By teaching this lesson the British difficulty promises to prove a boon to the American mining industry.

FEDERAL TAX REFORM

IN studying the Federal income tax system, the Congressional Joint Committee on Internal Revenue Taxation will have to consider carefully whether or not the greatest need for revision and simplification of the system lies in the law itself or in the structure that has been created for its administration. In the hearings before the House Committee on Ways and Means on the Revenue Act of 1926, most of the criticism of representatives of various groups of taxpayers was directed to the substantive provisions of the tax laws. Little time was given to discussion of the administrative provisions or to the methods, procedure and administrative regulations adopted by the Treasury Department in making the law effective.

In considering substantive reform, the Committee will have to take up the inheritance tax, the stamp tax on capital stock issues, the corporation income tax rate, and the question of depreciation allowances on plant assets. Strong pressure has been brought to bear upon Congress for the repeal of the inheritance tax. Repeal of the stamp tax on capital stock issues has been urged on the ground that it is a nuisance tax and a war-time measure that should not be continued as a permanent part of the taxing system. The enormous surplus in the Treasury justifies further tax reduction, unless the country favors a policy of rapid retirement of the war debt; and the fact that the corporation rate is far out of line with the rates applicable to individuals, which have had the benefit of all reductions made thus far since the war, should lead Congress to the conclusion that corporations should have the benefit of the next reduction.

The present tax law provides for "a reasonable allowance for the exhaustion, wear and tear of property used in the trade or business" and "in the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for * * * depreciation of improvements, according to the peculiar conditions in each case." But the strict rules of accounting imposed upon taxpayers under the Treasury regulations do not permit recognition of changes in values of depreciable assets which must be replaced at higher cost when exhausted or obsolete. Regardless of the merits of the case of the taxpayers, it is doubtful whether the Committee will recommend changes in the law for the purpose of permitting "reasonable" allowances for exhaustion, wear and tear, and depreciation, based upon changes in dollar values. Nevertheless, this question will be considered.

With respect to administrative simplification, there are many angles to be analyzed, involving procedure in connection with audits, assessments and appeals, burden of proof on appeals which now rests upon the taxpayer, maintenance of proper records of conferences and rulings, hearings in the field in the district of the taxpayer's residence, application of the statute of limitations and the use of waivers to toll the statute, correction of manifest errors in deficiency letters without forcing the taxpayer to first file his appeal with the Board of Tax Appeals or waive his right of appeal, fixing responsibility for decisions directly upon the officers; agents or employes of the department who actually make the decisions, and acceptance of the books and records of the taxpayer as evidence of taxable net income, where such books and records are kept on a consistent accounting basis, except in case of fraud. The foregoing are but a few of the questions that must be considered by the Committee before making its recommendations to Congress on administrative simplification.

In formulating its recommendations, the Committee will give equal weight to the views of taxpayers and their representatives with the views of officials of the Treasury Department. And constructive results are certain to follow. Out of the composite hearings and statements of investigators for the Committee, representatives of tax-paying groups, and administrative officials, the Committee should be able to formulate plans for simplification that will accomplish great improvements over the present system. The Committee intends to approach each phase of its great task with an attitude of absolute fairness, it wants the cooperation of the public as well as of the administrative officials of the Government, and it expects to perform its duties with due regard to the best interests of all.

LOCKING THE DOOR OF OPPORTUNITY

"The people of the East regard the public lands of the West and the Natural Resources found in them as the property of all the people, to be held by the Government in reserve."

NO, that isn't a quotation from a leaflet on socialism. It is a statement made at the recent convention of the Western Division of The American Mining Congress by the Hon. Secretary of the Interior.

In spite of the eminence of the authority, we can not believe that this statement correctly reflects the composite view of the people of the eastern states. Such a view involves adherence to a socialistic doctrine that never has been acceptable to the American people. It is contrary to the principles of American Government.

Eastern states have no public land question. Several generations ago the East solved all its public domain questions by giving citizens the right to possess, develop and pass on to posterity such property as it acquired.

But even with the problems of the frontier so far behind the East it is difficult to believe that any proportion of its population wishes to place burdens on their western brothers. To western states, the problems of development, improvement, utilization and taxation of the areas within their boundaries, are acute.

Public lands have never been regarded as the common property of all the people to be held in reserve, and developed and utilized under possessory titles which could never mature into fee titles. The policy of the founders of the Government, and of the Government, has been just the contrary. Under the homestead, timber and mining laws of the United States, possessory titles to limited areas were given only for short periods of time during which those in possession could show their good faith and intentions by complying with certain legal requirements as to development and improvements, after which the lands could be patented to the occupant in fee simple. The extension of the leasing system (originally applied almost entirely to Indian lands) to grazing and mineral lands, represents a radical departure from a time-honored policy of the Federal Government and threatens to envelop eventually the entire public domain.

Enormous expenditures of capital have been made in opening and developing mines and agricultural areas under possessory titles because the owners of this capital were assured of the ultimate absolute ownership which would guarantee the security of the improvements made against all who might otherwise seek to contest the rights of the owners thereof to the undisturbed possession and enjoyment of the fruits of their labor and enterprise.

Western states must have increasing taxation revenue for the construction and maintenance of roads and public schools, and other public improvements demanded and required as their populations increase, which can only be adequate, without undue burden upon any of their citizens, if the public lands within their boundaries are permitted to pass to private ownership and to become a part of the taxable property of these states.

If the basis of the claim that the public domain is the common property of all the people, is the fact that the lands were purchased originally with funds from the Federal Treasury, the answer is that these funds have been repaid many times over by homestead entrymen, mineral claimants, timber entrymen, and others who have acquired title to lands under the public-land laws. Had the Federal Government, during the nineteenth century, permitted only possessory titles to public lands under a leasing system, the western states would still be, for the most part, wild and undeveloped territories instead of great sovereign units of the nation.

The application of the doctrine that the public domain is an enormous common in which no one in the future may acquire more than a possessory title, would lock up opportunities, and would turn away from the great western states—that have always been regarded as the land of golden opportunity—the faces of those upon whom the country must depend for future progress and development on what is now termed the public domain. The primary inducement that must continue to be held out to both the tiller of the soil and the prospector and miner is ultimate complete ownership and unlimited enjoyment of the land he makes valuable. And it is up to the Federal Government to adopt and continue that policy which will best aid in the solution of the problems of the public-land states.

EMPLOYE OWNERSHIP OF INDUSTRIES

AN interesting sign of the times is the large increase in the number of small investors in corporate stock of our great industries. The wide diffusion of ownership in the nation's business enterprises is indicated by the fact that there has been an increase from about four million stockholders in our various industries in 1900 to about fourteen million in 1922.

The National Industrial Conference Board estimates that within another twenty-five years the individual ownership of manufacturing establishments in this country will have passed almost entirely. Along with this interesting commentary is a similar one by the New York Trust Company, which has compiled a list of twenty-two industrial enterprises and public utilities showing 315,497 wage earners owning 4,258,470 shares of stock with a present market value of $454,963,382.

Princeton University, through the industrial relations section of her Department of Economics, estimates the value of stock controlled by wage earners as $700,000,000; and, if we add to the number of wage earners the office workers who own stock, it is not unreasonable to estimate the total value of stock controlled by corporate employes at more than $1,000,000,000.

These facts are significant. In the first place, they indicate a willingness on the part of capital, not noted to any great extent at the beginning of the twentieth century, to welcome their employes as partners in their enterprises through stock ownership; secondly, it shows that the average wage earner and salaried employe are obtaining compensation that permits them to have a surplus to invest; and finally, it shows a decided step upward and forward for the wage earner in that he has learned to save and to invest.

The brief of the American Mining Congress General Tax Committee, presented to the Finance Committee of the United States Senate at the time the mining provisions of the Revenue Act of 1926 were being considered, called attention to this movement by pointing out that:

"Like all great revolutions, it has come so quietly that it is hardly realized until the figures are assembled. As a result we are beginning to see almost every citizen as a potential or actual capitalist and interested in our great industries. The modern form of corporate organization not only makes this possible, but welcomes the participation of the public as capitalists in the industry, either as bondholders or stockholders.

"This increasing profit ownership is not only fine evidence of habits of thrift, but is one of the most stabilizing influences in our country. It is a sure cure for radicalism. It is being increasingly recognized that one who owns nothing has nothing to lose but everything to gain by radical change. Thus, such a person affords fertile soil in which to sow seeds of discontent. If, therefore, to discourage radicalism and Bolshevism is sound, this new economic revolution should be encouraged and safeguarded in every way possible. It is a welcome sign that of every man, woman and child, about one in every seven in the United States is possessed of some shares in our great industrial and railroad corporations, and this diffusion is going forward at an accelerated rate."

The unusual tranquillity of labor today, generally, indicates that conditions are such that they are sharing to the fullest extent in our national prosperity. Labor is recognizing economic truths more than ever before and none is more potent than that labor's wage must come out of what labor produces. Labor is beginning to realize that the extent and continuity of its income depends very largely upon its own efforts for the good of the whole people.

In no industry are these facts less applicable than in the mining industry. The idea of diffusion of ownership through stock purchase by the miners has not grown as rapidly in mining as in other industries. Henry Ford has inaugurated a plan in force at his mining properties that permits his wage earners to invest in his enterprises any proportion of their wages they may choose, and guarantees them a minimum return. When an employe leaves the enterprise, his "investment" goes with him, because he can not invest with Mr. Ford unless he is employed by a Ford enterprise.

If employe ownership of stock has helped to solve the labor question in other industries, why is it not a good thing for the mining industry? And why should not the mining industry give to it unlimited support for the purpose of (to again quote the Mining Congress Tax Brief)—"(1) encouraging thrift, (2) a stabilizing influence against radicalism, (3) a prophylactic against Government ownership, and (4) a means of breaking down the old alignment of labor against capital and so prevent or lessen the evils arising out of such strifes."

THE HYDRAULIC MINER

WHEN in 1881 the hydraulic miners of California lost their legal battle to permit the continuance of this form of mining, there were 425 mines operating in the Sacramento and San Joaquin valleys. The testimony in the test case showed that at that time there was invested in hydraulic mining approximately $100,000,000, with six thousand miles of ditches and canals that had been built at a cost of $3,800 per mile. From the date of the decision of the courts in 1881 to the enactment of the Caminetti Act, which had for its purpose regulation of hydraulicing on the Sacramento and San Joaquin rivers, the industry in California took on the aspects of our present bootlegging industry.

In spite of the provisions of the Caminetti Act, difficulties beset the hydraulic miner to such an extent that within a few years only the most courageous were still trying to operate. The disposal of tailings is the prime problem of this process of mining. Unlike the dredge, which can create its own flotation and control its waste disposal, hydraulicing requires grade and distance below the scene of operation. Mining men familiar with hydraulicing in the Klondyke recall a condition there very similar to the California situation. Water rights were jealously guarded and maintained at tremendous expense.

California seems at last to have found the right road, and with the action of the state legislature in appropriating $10,000 to investigate the possibilities of rehabilitating this industry, it is hoped that the problem may be solved and that many bed-rock flumes may be opened. The reopening of hydraulic mining will mean new centers of wage distribution through the upkeep of ditches and sluices; it will mean new markets for the farm products of the valleys, and a general renaissance of mining activity in California, where gold production has steadily declined. Certainly with the cooperative spirit manifested, we may expect peace and prosperity in the Sacramento Valley.

WESTERN STATES JOINT CONVENTION

Western Division, The American Mining Congress, With The Cooperation American Silver Producers Association, American Institute And Petroleum Geologists, Hold Meeting of Vast Importance To Western Mineral Industries

EVERY phase of western mining was represented at the Western States Joint Convention just concluded at Denver, Colo. The convention was called at the instance of the Western Division of the American Mining Congress, which represents 10 western mineral-producing states, including Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, South Dakota, Utah and Washington. The cooperating associations were the Colorado Section of the American Institute of Mining and Metallurgical Engineers, the American Silver Producers' Association, and the American Association of Petroleum Geologists.

The program, which was arranged by Hon. Jesse F. McDonald, governor, and M. B. Tomblin, secretary, Western Division, The American Mining Congress, was of outstanding importance and was participated in by Government officials, western Congressmen, and leading mining men from every branch of the industry.

At a business meeting held on September 20 by members of the Western Division, The American Mining Congress, Salt Lake City, Utah, was selected as the place for the 1927 meeting of the division. Imer Pett, manager, Bingham Mines, Salt Lake City, Utah, was elected governor of the division to succeed the Hon. Jesse F. McDonald, and A. G. Mackenzie, secretary, Utah Chapter, The American Mining Congress, was elected as secretary, vice M. B. Tomblin, secretary of the Colorado Chapter, The American Mining Congress, who has served the division so efficiently during the past year. The following directors were elected: Robt. E. Tally and W. B. Gohring, for Arizona; P. C. Knapp and Robt. I. Kerr, for California; Jesse F. McDonald and M. B. Tomblin, for Colorado; A. P. Ramstedt and Ravenal Macbeth, for Idaho; W. B. Daly, for Montana; C. B. Lakenan and Henry M. Rives, for Nevada; John M. Sully and Joseph Woodbury, for New Mexico; Robt. M. Betts, for Oregon; B. C. Yates, for South Dakota; Imer Pett and A. G. Mackenzie, for Utah.

The convention opened Monday morning, September 20, in the Colorado room of the Cosmopolitan Hotel, with a meeting of the Western Division of The American Mining Congress, Hon. Jesse F. McDonald presiding. This session was devoted quite largely to a discussion of our public-lands question, with addresses by Hon. Hubert Work, Secretary of the Interior; Hon. Wm. Spry, Commissioner of the General Land Office; Hon. Chas. E. Winter, United States Representative from Wyoming; and Hon. Geo. H. Dern, governor of Utah. The papers delivered by Mr. Work, Mr. Spry, Congressman Winter, and Mr. Dern are found in full elsewhere in this Journal.

The Colorado State Capitol

Silver Problems Discussed

The American Silver Producers' Association called their meeting to order on Tuesday morning, September 21, with W. Mont Ferry, president of the association, presiding. This session was an open meeting and not a meeting of the members of the silver producers' association. In opening the meeting, Mr. Ferry briefly outlined the history of and purpose of his association. He stated that it represented 50 percent of the world's production of silver and 90 percent of the American production. He said that its work was supported by its producing members, although non-producing members paid a nominal fee as dues. He made a special plea for membership, urging the cooperation of all silver producers, if the work of the association is to go forward and to be effective. Addresses were presented by F. H. Brownell, first vice president of the American Smelting and Refining Co., on "What Can be Done for Silver," and by the Hon. Chas. S. Thomas, former Senator from Colorado, on "The Administration of the Pittman Act."

Mr. Brownell's address covered the trend of silver since the war, history of the use of silver, the present monetary system of India, the reason for the report of the Royal Commission, a review of the case presented to the commission, India's recent absorption of gold, the commission's decision, the amount of silver India may sell, the effect of the commission's decision upon the silver producers and upon all countries, and a number of suggestions as to what can be done for the silver industry, which he summarizes as: Prevention of the threatened action of India, fostering the resumption of subsidiary coinage in Europe as currencies of various nations when they become stabilized, and the carrying on of propaganda for increasing the use of silver in the arts. Mr. Brownell's paper appears in full in this issue.

Silver and the Pittman Act

Senator Thomas in his address referred to the "all-importance of silver, a topic which persists in being considered notwithstanding legislation or machinations, or both, against its interests." In arguing for the pending bill in Congress for the purchase of 14,000,000 ounces of silver at $1 per ounce to complete purchases under the Pittman Act, Mr. Thomas took the Treasury Department to task for substituting its discretion for the law. He reviewed at some length the reasons which prompted Congress in 1918 to pass the so-called Pittman Act authorizing the sale of silver dollars to England to uphold the Indian currency situation, such silver to be replaced by purchases from American producers. He

stressed the importance of maintaining silver "as one of our money metals." He pointed out that the subsidiary coinage feature of the original Pittman Act was placed in the law at the suggestion of the Treasury Department, and argued that as the Treasury had used Pittman silver purchases for subsidiary coinage purposes, it should be replaced by original silver purchases. Senator Thomas charged that Undersecretary of the Treasury Gilbert concealed some facts and misled the Comptroller General as to others in connection with termination of purchases under the act, by which the Senator claimed the Government did not fulfill its obligations to the extent of 14,000,000 ounces, which he insisted should be purchased at $1 per ounce. "The effect is a loss of $5,000,000 to the silver producers," said Senator Thomas. "No appropriation is needed for the purchase of this silver. It is merely an exchange." He stated that the Government had profited to the extent of nearly $16,000,000 by refusing to purchase this silver. Senator Thomas stated that the silver purchase bill will be reported promptly by the House Banking Committee when Congress meets early in December. He thought the bill would be passed "if we have behind it not only the moral but the physical support of this great organization, The American Mining Congress." He praised Secretary of the Treasury Mellon, but said that his subordinates, "beginning with Mr. Gilbert and ending with Mr. Winston (the present Undersecretary) have up to this time been able to defeat this act of very ordinary, common and necessary justice."

Senator Thomas stated that purchase at this time of this silver by the Government would have "a wonderful effect—temporary, perhaps—upon the mining industry." The Senator stated that $45,000,000 must be coined and added to the reserve before the number of dollars melted and the amount of bullion sold is replaced, which is three times the amount of silver involved in the pending bill. "It is strange that one of the Government's departments should be standing between the producer of silver and the mandate of the law," said Senator Thomas. He said that if the natural laws of production and trade with regard to silver are left alone, price fluctuations of silver would not occur, and in support cited transactions of the Federal Reserve Board regarding exportation of silver, saying that while the law regarding coin was continued in force, it was set aside with regard to bullion, which forced down the price of silver. He also stated that the Government should purchase 14,000,000 additional ounces to cover transactions of the Federal Reserve Board with international banks in connection with settlement of silver balances with Asiatic countries.

Session of Petroleum Geologists

The Tuesday afternoon session, September 21, was devoted to a discussion of the problems of the petroleum geologists being under the auspices of the American Association of Petroleum Geologists, Alex. W. McCoy, president of the association, presiding. "The Geology of Western Kansas" was presented by Glenn C. Clark; "The Amarillo District," by J. V. Howell, and "The Geology of Southwestern Texas," by J. W. Breede.

Future Demand for Minerals

The American Institute of Mining and Metallurgical Engineers held two sessions on Wednesday, September 22. At the morning session John W. Finch, president of the Colorado section presided. A paper was presented by Samuel A. Taylor, president of the American Institute on "Some Aspects of the Coal Mining Industry." Mr. Taylor's address will appear in full in the November issue. The future demand for minerals was a paper presented by H. Foster Bain, secretary of the American Institute, and Dr. M. F. Coolbaugh, president of the Colorado School of Mines, delivered a paper on "The Progress of Leaching and Electrolytic Metallurgy." "Selective Flotation" was presented by Prof. H. A. Weinig, superintendent, experimental plant, Colorado School of Mines, and M. J. Gavin, refining engineer, United States Bureau of Mines, presented a paper on "Initial Results of the Government's Oil Shale Testing Plant."

For much longer than the period of interest to our generation there will be ample and remunerative work for miners and metallurgists, said H. Foster Bain, secretary of the American Institute of Mining Engineers, in speaking on "The Future Demand for Metals." If the world wants metals badly enough to pay for them, the supply will be forthcoming, through new discoveries, improved technology, conservation of present stocks, and perhaps a revision of uses.

"There can be no dispute as to the fact that mineral deposits are exhaustible," Dr. Bain declared, "but it is undoubtedly true that our geological knowledge, large as it is, falls far short of completeness." Deep mining offers the great hope of increasing the available supply of minerals, and technology and economics must combine to open up these future reserves.

He stated that the world today is using more metals than ever in its history; that the demand is becoming more universal and that never will humanity go back to the "vegetable civilization" of China, which depends chiefly upon plant life for its needs.

"In 1820," he said, "this country produced and used only five pounds of pig iron per capita, and in 1920 the amount was 100 times as much, or 597 pounds. It has increased since this and touched a peak of 809 pounds in 1923.

"In the last 15 years the world's copper output was as much as in all the 110 years before, and the demand made on our other reserves of minerals has corresponded. Since 1900, we have used more of our mineral resources than in all preceding history.

"Clearly the world is coming to depend on minerals rather than on the products of the plant and animal kingdoms. The increasing dependence on minerals and the larger individual consumption of them is most striking in the United States."

He submitted figures showing that the per capita consumption of virgin copper, lead and zinc in the United States has increased since 1910 in the following manner:

Per capita consumption in pounds	Copper	Lead	Zinc
1910	7.96	8.25	5.35
1925	12.42	11.67	8.87
Percentage increase	56	41	66

But not only in America is the demand for metals growing year by year. European metals consumption is subnormal but even there the demand of the people for greater comforts and conveniences establishes a potential use of metals which is very great.

The American metal miner and producer, therefore, is concerned with three questions, Mr. Bain said:

"Will the various peoples want metal goods badly enough to work for them?

"Can the actual supply of metals be found to satisfy the demand?

"To what extent, if any, will substitutes and synthetics take the place of the minerals?"

Increase in housing, transportation and conveniences is what the world wants and to supply them heavy drafts must be made on the minerals.

Mr. Bain is of the opinion "that this demand is real, that it is growing, and that something of the great potential call for metals already indicated will be realized within a period important to present producers.

"It is a matter of developing methods of finding and working such ores at a price the world can pay. The unexhausted reserves of the human mind are man's best protection.

"It is wonderful what we can do when we must and one familiar with the progress being made in instrumental prospecting and lowering costs through application of improved technology and better management, hesitates to set a limit to the possible. Already buried salt domes, oil fields, and sulphur deposits have been found by use of the

torsion balance and the seismograph and a wide variety of electrical and magnetic methods are in daily use in the search for metals.

"The possibilities in this direction are as yet unlimited. In lowering costs of production by large scale operations, by improved technology and by well planned direction, the porphyry coppers blazed a trail others can and do follow. Mining copper ore of 1 percent content is in fact being surpassed at the Alaska-Juneau mine where ore containing 87 cents per ton in gold is being worked at an operating profit on a scale that added $2,000,000 to the world's output in 1924.

"Two trends are discernible in modern production that operate to relieve pressure on the mines for new metal and toward stabilization of price. These are (a) the accumulation of stocks in use of metals reclaimable after use; and (b) the ability to make substitutions. Metals differ from wood, hides, wheat, and similar products in that under many conditions of use they are virtually indestructible. Of the zinc consumed in the United States in 1925, 10 percent was reclaimed from previous use; of the lead, 16 percent; of the copper, 37 percent. A large and growing part of the burden of open-hearth furnaces is made up of scrap, running at times and in individual plants up to 100 percent. For the country as a whole in 1925 the percentage was approximately 35 percent. In Germany at present, according to a recent observer, 65 percent of the usual furnace burden is scrap. Immediately after the war markets were disorganized by the flood of secondary metal suddenly made available. This has now been absorbed but the normal tendency is for the aggregate stock to increase and the new metal added to that aggregate each year to become less and less in percentage, though the actual tonnage may be more. This makes for stability of price and production.

"The world's stock of gold represents the total of past production, less actual loss through the years. The fact that the amount added to the total in any one year is but a small fraction of the grand total, is the main reason for the relative stability of the gold price. Stocks of other metals for our use and reuse are also accumulating. It may well happen in time that by reuse, the essential needs of mankind may be met with only small annual additions of virgin metal, much as cyanide solutions are kept up to strength in make-up tanks.

"To bring this about it will be necessary to improve practice as regards metal losses and here lies a big field. Only a small part of the zinc mined and smelted at so much cost is recovered after use. More of the lead comes back and still more of the iron and yet, according to estimates made by Sir Robert Hadfield, 20,000,000 tons of steel is rusted or wasted annually. For lead the third largest use is still in the making of paints from which there is substantially no recovery. White lead paint is in a class by itself but it may be wise to promote still more the use of lead in batteries, cable coverings and other fields where there is a large recovery, and turn to other materials for all but special situations when white paint is desired.

"It will be by improvement in technology, such as decreasing losses from corrosion, and through substitution of more common for less common materials, that the world's needs will be met when the cost of mining any virgin metal becomes excessive, and the stocks available restrict the supply to essential uses. This is a long difficult road to follow. The chemists have made a brilliant beginning here and, while we may occasionally smile at the enthusiasm as of youth that leads some of them, like politicians, to claim everything, as miners and metallurgists we gladly recognize the service they are performing.

Physical Chemistry the Basis of Future Progress

Agreeing that it was a broad statement, Dr. M. F. Coolbaugh, president of the Colorado School of Mines in discussing the subject of leaching, declared that physical chemistry must be the basis of future progress, for the subject demands the highest type of chemical and metallurgical energy.

"I do not wish that you should realize that all metallurgists are in harmony as to their methods of treating metals," he said. "If they were in harmony it would probably mean a lack of progress. We can divide them into two classes—the pyro-metallurgists, or the metallurgists using fire means, and the hydro-metallurgists, or those using leaching methods.

"The leaching of ores is not new. The leaching of ores for the recovery of metals, however, is quite new. The older leaching was simply to recover the salts.

"Leaching had its beginnings with gold and silver ores; it had its big start as a metallurgical process when the cyanide method of treatment was discovered. It was slow in developing but during this development the mechanical engineer came to the aid of the metallurgist. He invented many machines for handling large quantities of material in the form of pulp.

"Not only did the cyanide process start us along that line but it started chemists. The chemists began to study carefully the nature of the solutions—the chemical reactions that were taking place—the impurities and how those impurities could be eliminated; and the metallurgist began to reason thus: If we can treat ores containing gold and silver by hydro-metallurgical methods, can leach them and get their values, why can we not apply this method more universally to the recovery of other metals?

"In the recovery of the other metals, we started with the oxidized ores. These were naturally the easiest ores to treat; they require some cheap solvent, and many of the oxidized ores will respond to such treatment and a larger percentage of their values will go into solution."

Leaching has come on as a very practical method of gaining our metals within the last 10 or 15 years, according to Dr. Coolbaugh, and has spread from the oxidized ores to the unoxidized ores. In this connection he said:

"The unoxidized ores, or the sulphide ores, require treatment before they can be leached. There are re-agents that will react with the sulphide ores and take the values into solution, so to speak. These reagents, however, are not cheap, and while we may have processes in the future that will relieve us from this preliminary treatment, there is no indication now that this will come quickly into use. The roasting of the sulphide ores is now considered as absolutely imperative for the preliminary in leaching, and, for example, I will say that the work on roasting of complex or zinc ores has progressed probably further at Anaconda and the Consolidated Mining and Smelting Co. and by our Australian companies than at any other.

"When this work was started, it was considered that all you had to do was to roast an ore and treat it with acid and that the values would generally go into solution. A study of the question has shown that many compounds may be formed in the leaching of ores that make them even more insoluble than they were in the roasting of ores, that make them more insoluble than they were before the roasting commenced. This has opened up a new line of study to find out what these insoluble compounds are, how they can be prevented in their formation, or how they can be treated if they are formed, with some type of reagent which will dissolve them.

"Now, methods are being experimented upon at the present time in Denver that indicate that roasting can be effected without the formation of these detrimental insoluble compounds. It has been found that if in the roasting process the ores and the air for oxidization travel in the same direction throughout the roasting process, the sulphur gases produced will prevent the formation of the zinc-iron compounds which are insoluble; and to go a little further in this and make it more general, as to the compounds of zinc and iron which are in-

soluble and which have been found so detrimental in the metallurgy of the zinc, similar compounds are formed with iron and copper in exactly the same way; so it was not impossible to tie up all of the copper in a concentrate in an insoluble form by roasting it.

"When I say 'all'—and I mean that in the strict sense of the word—roasting that in certain temperatures and under certain conditions, instead of liberating the copper will tie it in a compound more difficult in solution than the original compound of the copper itself, until now in this method of roasting, the ore and the air for roasting, the products of the roast and the gases produced in the roasting all travel in the same direction through the furnace, and these compounds do not tend to form, and if they do tend to form, they are decomposed and they get toward the end of the roasting operation.

"This type of roasting produces in the upper and middle parts of the furnace a maximum quantity of sulphates, which in themselves are water soluble, and in many of our leaching methods it is not desirable to have this large quantity of sulphate present. Experimentation, however, has shown that this method of roasting can be used and at the same time regulate within very close limits the quantity of water-soluble sulphate that is produced in the final product. This is done by introducing an appreciable quantity of raw sulphide ore toward the end of the roast.

"The introduction of this rather large quantity of sulphide ore toward the end of the roast answers two purposes—it breaks the sulphate formed and it makes a temperature control which will prevent the formation of the insoluble or ferrite compounds.

"What we will see in the next ten years is a mere matter of speculation. However, the leaching curve is on the upward trend. Unless the people, who believe in the fire or pyro-metallurgy get on their toes, unless they give more attention to the scientific development or basic development of the recovery of metals from this source, we can only predict that they will take a secondary place in metallurgy."

Flotation Process Still in Infancy

Although the flotation process is still in its very early infancy, according to Prof. A. J. Weinig, superintendent of the experimental plant of the Colorado School of Mines, it has effected greater changes in mining practices than any other method of ore treatment in a similar length of time. Professor Weinig attached this importance to the art of flotation in his paper, "Selective Flotation." One of the greatest advances of all times in metallurgy is the art of flotation, which today occupies the same relationship to the state of civilization that metallurgy has occupied in all times of the past, Professor Weinig believes.

"It is a pioneer art," he said, "entirely empirical and without a true charted scientific fundamental. No other art has stimulated so suddenly the need for scientific research or so quickened the pulse of our scientific thought. The flotation process has sprung into being so rapidly that it is yet impossible to accurately estimate its magnitude. In a very few short years it has sprung into importance second only to the blast furnace smelting of iron ores. At this hour it is probable that the rate at which ore is going through the flotation mills of the country alone is near 50 million tons per year. The operation is gaining speed at a very great rate and it is also very probable that before another year rolls around it will be the greatest process from the standpoint of tonnage treated in all metallurgical industry.

"We have learned that flotation in itself is essentially a selective process and not a bulk process which for several years we tried to conceive it to be, and in this selectivity it has shocked us into the realization that a large portion of the millions of tons of concentrate fed to the blast furnace at so great a cost in freight and treatment really was not worth loading aboard the cars. Flotation is, therefore, fast protecting us from a great economic waste. Where formerly four cars of ore went to the smelter, now one is sent, containing even more metal in concentrates than the four cars combined, as records of one mine disclose. As a result of this, the blast furnaces at this mine were all shut down and the small tonnage then treated in reverberatory furnaces with reduced smelting charges and metal losses lowered.

"These changes represent the trend of change in the whole copper industry. A second application of flotation is the separation of the so-called complex lead-zinc-iron ores.

COOPERATIVE CONVENTIONS

Mining men of the West met at Denver to discuss in open forum the economic, political, technical and cooperative problems of western mineral industries. Public lands, their disposition and control, was ably discussed by government officials, political representatives and mine operators. It was a weighty discussion of a thing that has hampered full development of the West.

Silver men met in large numbers and frankly discussed their problems. Remedies were suggested that should have the united support not alone of the silver producers, but of the whole mining industry.

Leaching, flotation, the recovery of oil from shale, the location of new mines, are but a few of the other problems under consideration. At each session the interest was sustained and the benefits to western mining from such discussions cannot but be highly beneficial.

The American Mining Congress was sponsor for the meeting. Its Western Division which issued the call and was responsible for the program, was successful in securing the cooperation of the American Silver Producers Association, The Colorado Section of the American Institute of Mining and Metallurgical Engineers and the American Association of Petroleum Geologists.

Denver was an ideal center in which to hold the meeting. Colorado is making great strides in her plans for the rehabilitation of her mining industries, and enthusiasm in working out the problems was never more evident.

The joining hands of these associations in discussing their problems was an experiment, but one well worth while. The great fundamental purpose back of the American Mining Congress has been the securing of the cooperation of every branch of mining in solving the individual and collective problems of the industry.

The national conventions of that organization attempt to do in a national way what its Western Division attempted at Denver. It is the only manner in which the industry will work out its salvation. If the metal miner understands the problems of the coal operator; if the geologist understands the problem of the mine operator; if the engineer is more conversant with conditions that must be met in the industry as a whole; if the Congress of the United States understands that Coal and Metal and Oil are but children in a great family; if the Industry itself will forget partisan lines and work for the general good of mining, that industry will prove a powerful unit and its movement onward will be certain.

Coal, metals, oil—a great family with common problems—and individual problems—united on a platform that puts MINING ahead of any one part of the industry.

Here again flotation has taught us that the iron pyrite is usually a waste product. The separation of the lead and zinc minerals in a highly concentrated form has again led to important changes in the various smelting procedures that follow.

"As a third application we note that the entire molybdenum production of this country is won by flotation, again by elimination of a large portion of the ore as a barren iron pyrite. The low costs of this operation whereby ores of less than 1 percent grade can be treated, has, in a great measure fostered the recent large application of molybdenum steels. Here flotation is having a marked influence on the development of the steel industry.

"We have noted that the elimination of iron pyrites from our various concentrates has been one of the main applications. I may mention that flotation is now saving that same iron pyrite for use in the manufacture of sulphuric acid. The recent uncertainty and rising costs of gulf sulphur is directing the attention of acid manufacturers again to the use of pyrite. Flotation stands ready to supply this demand.

"The non-metallic mineral flotation again is applied to the recovery of graphite with very great success. It bids well to enter the field of mica, of flourite and of spar. In the coal industry flotation, in certain instances is recovering fuel from former wastes, and in the smelting flotation is not only saving waste fuel, but working up by-products as well.

"Oxidation is the worst enemy of flotation. Its application to oxidized ores is yet very limited. Flotation is faring better with the so-called secondary ores but we have yet complications here which have not been completely worked out. With the primary ores flotation is supreme, and since the development of these ores is the greatest future resource of our nation, we may expect that flotation will have a long and fruitful career as a gift of the metallurgical art to the service of mankind."

Oil Shale Testing Plant

In his discussion on the results that have been obtained by the Governmental Oil Shale Testing Plant at Debeque, Colo., M. J. Gavin briefly described the plant, the tram which carries the oil shale to the plant. He pointed out that public opinion seemed to be that they had spent their total appropriation without completing the plant and that it would now close down. This statement is not only erroneous, he said, but, on the contrary, they have not only been able to complete the plant as originally planned with one retort of the Scotch type, but they have been able to add a retort of the N. T. U. type. This plant is now operating and producing oil. Its purpose is experimental, and the aim is to try all the various kinds of shales and to produce the best possible oil from each. Mr. Gavin was of the opinion that the mining of shale is the greatest problem. He pointed out that at the Scotch oil shale plants the mining of shale makes up 53 percent of the total cost. He is convinced that the major portion of the problem in producing oil from shales is one for the mining engineer.

Ore Hunting in Colorado

The Tuesday afternoon session, presided over by Chas. W. Henderson, secretary of the Colorado Section, included papers by Dr. Geo. Otis Smith, Director, United States Geological Survey, on "The Ever New West." A paper was presented by Dr. W. C. Mendenhall, Chief Geologist of the United States Geological Survey, on "Ore Hunting Geology in Colorado." "Ore at Deep Levels in the Cripple Creek District" was presented by G. F. Loughlin, Chief Metallurgical Geologist of the United States Geological Survey, and a paper by C. H. Birdseye, Chief Topographer of the United States Geological Survey, on "The Future Program of Topographical Mapping in Colorado and the Rocky Mountain States."

Ore at Deep Levels

In discussing ore at deep levels in the Cripple Creek District, Mr. Loughlin summarized the work of the resurvey of this district which is now in process. He reviewed the conclusion reached by Waldemar Lindgren and F. L. Ransome in the earlier survey of the district to the effect that production would gradually decrease because of (1) increased cost of mining at greater depth, (2) there were fewer veins at greater depth, and (3) depth might be reached as tellurides had not been formed. He briefly outlined the geology of the district as a volcanic neck, fissured by settling and cracking of the neck, but that deeper work has shown that regional forces had had some effect. The problem in the Cripple Creek District is largely structural; that is, what structure controls ore disposition and what is the origin of the ore. He asserted that ore bodies are of three types known as: 1, Common vein; 2, the Cresson type, in which the ore looks like dark grey, breccia with no mineral in it; and 3, low-grade pyritic ore. Mr. Loughlin is of the opinion that future exploration of the district will require both nerve and money, that the veins are fingering out downward, and that the problem will be to determine which are the master fissures and to concentrate future efforts on these.

Topographic Mapping

Mr. Birdseye, in his paper on the "Future Program of Topographical Mapping in Colorado," stressed the need for topographic maps now, not 50 years hence. He gave the present status of topographic mapping as follows: Colorado, 52 percent mapped; Wyoming, 30 percent mapped; Utah, 22 percent mapped; and New Mexico, 33 percent mapped. Of the portions already mapped, some of the earlier maps are so poor as to be useless. Mr. Birdseye asserted that since the war there has been far greater demand for maps. He stated that beginning in 1924 a comprehensive program of mapping began which is to be carried forward on the basis of cooperation with the states. He stated that little has been accomplished so far because the states which should be interested have not come forward with their cooperation. His estimate as to the cost of topographic mapping depends upon the scale and contour interval of the maps and the relief of the country.

He estimated that the approximate cost of mapping in mountainous regions is as follows:

Scale 2 miles per inch—$20 per sq. mile.

Scale 1 mile per inch—$40 per sq. mile.

Scale ½ mile per inch—$80 per sq. mile.

In very special cases he felt that aerial topography may supplant ground surveys as, for example, in the mapping of lands of very low relief. But its greatest value will probably be in checking maps and in bringing old maps up to date.

Efforts to Locate New Ore Bodies

Dr. Mendenhall in presenting this paper on "Ore Hunting Geology in Colorado," told the convention that Colorado will be prospected from one end to the other for mineral values in the greatest ore hunting expedition yet to be undertaken. Dr. Mendenhall's paper was a review of the cooperative enterprise which is under the direction of the Colorado metal mining fund and the United States Geological Survey. It was pointed out that the Government in conjunction with the state will go over every foot of mineralized lands or those likely to contain minerals in a special effort to locate new stores of gold, silver, lead, copper and zinc. The work, Dr. Mendenhall said, will take years to complete for it involves not merely a search for new lodes but a re-examination of every known deposit.

He asserted that "Colorado may not again produce a billion and a half dollars worth of mineral wealth, but discoverable and as yet undiscovered values do exist in this state.

"Colorado miners and geologists know that; Government experts at Washington know it. But where are those values? In such a vast and broken territory, neither the Colorado miners nor the Gov-

ernment bureaus separately can devote enough time, men or money to the necessary investigation. The Federal geological survey has to serve other states as well as Colorado, and its men and money are limited."

Confronted by that situation, Dr. Mendenhall said, Colorado's mining men suggested their willingness to pay part of the cost of having the geological survey devote more attention to Colorado. And so the Colorado mining fund was established, and the miners, metallurgists and geologists of the state have joined hands with Government experts in these steps:

Re-examination in a scientific and very exhaustive manner of all existing sources of mineral wealth.

Tabulating exactly the facts of geologic structure, the amount of ore found, its quality, and the amount taken out.

Preparation of topographic maps, which are essential to a study of the ground.

From their study of existing mines, the experts will obtain facts to aid them in locating new ones. They know, for example, that the early prospectors, and some later ones as well, passed over supplies of lead, copper and zinc, because those prospectors were interestd only in gold. Now lead, copper and zinc deposits are potentially almost as valuable as the gold—certainly more valuable than the low grade gold ore now remaining.

"The general plan of the survey or prospecting work," said Dr. Mendenhall, "is to supplement general studies with specific, detail studies. That will include a hunt for deep ore veins, below levels now worked."

Ore Finding

At the evening session on Wednesday, September 2, Augustus Locke presented a paper on ore finding. Mr. Locke told the delegates that the old mining days in which men stumbled over surface outcroppings of ore, followed their leads and developed mines worth millions, are gone forever. Cheap modes of prospecting must now give way to scientific and to more costly methods. Mr. Locke said:

"The modern work of locating ore, is a complex process even in the old camps where bodies are known to exist. To locate new camps is still more difficult, and with all the resources of money and science, there have been few new camps opened in the last dozen years. All that the men of scientific training can do is to employ all the established facts and information acquired in the past and endeavor to avoid useless exploration in barren fields and to direct exploration in likely fields with the least possible margin of mistakes, and in the most economical and effective manner possible.

Photograph by W. J. Hutchinson, Courtesy U. S. Forest Service

Camp Bird Mill And Mine, Uncompahgre National Forest, Colo.

"That is the work of the trained mining man and geologist, and, thanks to recent accomplishments of science, he is now provided with more effective equipment than ever before. He is employing the seismograph, the torsion balance, the stratigrapher, the dip needle, the galvanometer, the petrographer and other scientific instruments, and from their records he must draw conclusions that necessarily are not free from the element of chance.

"No one would be so foolish as to overlook the fact that we really know very little as to why an ore vein lies in one place rather than in another, or why a great string of ore bodies is found in one locality rather than in another, as for instance, in Bisbee rather than in Gleeson. So far as our knowledge applies in many cases, it is pure accident. No definite principle is known as to where a large proportion of the lost ore bodies are to be relocated.

"Speculation is the life of ore finding. It releases energy for the task and keeps the interest alive and active. It is the ever-questing hunt for wealth, the ever-pressing needs of industry that keep up the interest in the quest for gold and silver, copper and iron, lead and zinc and many other minerals, and the best the men of science can do is to help direct this quest in the most efficient manner with the scientific means at their command."

Mining in National Forests

On Thursday morning, September 23, duplicate sessions were held, one under the auspices of the Western Division and the other under the auspices of the Petroleum Geologists. J. F. Callbreath, Secretary of the American Mining Congress presided at the session of the Western Division and the following papers were presented:

"Mining in National Forests," by E. H. Sherman, Associate Chief Forester, U. S. Forest Service; "A Western View of the Forest Service," by Geo. E. Collins; "The Service Rendered the Mining Industry by the Bureau of Mines," by Dorsey A. Lyon, Chief Metallurgist, U. S. Bureau of Mines; "The Small Operators Technical Staff," by Max Ball, nationally known geologist, and "Mine Safety," by E. H. Denny, District Engineer, U. S. Bureau of Mines. At the session of the American Association of Petroleum Geologists, Alex W. McCoy presided at both the morning and afternoon sessions and the following papers were presented:

"Rocky Mountain Geology," by R. C. Coffin and T. S. Harrison.

"The Structure of the Coast Range and its Relation to the Rocky Mountain Province," by Dr. Bailey Willis.

"The Northern Cordilleran Geosyncline and its Relation to Petroleum Accumulations," by C. A. Fisher and E. Russell Lloyd.

In presenting his paper on "Mining in the National Forests," E. A. Sherman, Associate Chief Forester, U. S. Forest Service, said:

"It is the policy of the United States Forest Service to encourage the develop-

ment of the mineral resources within the boundaries of the national forests, and officers of the service are instructed to aid and cooperate with the industry in every practical way. It is a known fact, that the policy has been followed in an overwhelming majority of cases. No man has a place in the service who fails to cultivate a friendly, helpful, cooperative spirit in his relations with those who are endeavoring to develop the mineral wealth in the areas covered by the National forests.

"The national forests on June 30, 1925," Mr. Sherman said, "contained a total of 158,395,000 acres in 48 states, Porto Rico and Alaska. Aside from the vast stores of reserved minerals, they represent the most valuable property collectively owned by the people of the nation. The Forest Service is merely custodian of this property. It was not the purpose of Congress to reserve for forest purposes lands more valuable for their minerals or for agricultural purposes, and provision was made for the continuation of prospecting and patenting under the mining laws, as though the lands were a part of the public domain. This is the law today, except as Congress itself has made other dispositions of lands, such as under the water power act, and other acts providing for land needed for power transmission and the like.

"The law under which patents are issued to lode mining claims upon payment to the Government of $5 an acre was passed by Congress June 26, 1866, or 60 years ago. On July 9, 1870, or 56 years ago, Congress authorized the patenting of placer claims upon the payment of $2.50 an acre. Land values for any purpose at that time were low. In the mining regions there was little, if any, raw land which would sell at such a price unless it did have unusual value by reason of the presence of valuable minerals. Usually the land was not worth 10 cents an acre for any other purpose. If it was worth anything at all for mining, the $2.50 or $5 an acre was of small consequence.

"These laws unchanged as to the purchase price of lands bearing precious metals, still apply to both the unreserved public domain and upon the national forests. As to the public domain, its action is still logical. The remaining lands are of low value. Usually no one would dream of paying $2.50 to $5 an acre for such lands unless they are actually worth that for mineral. In the national forests conditions have changed materially since the law was passed. Instead of the lands being without commercial value for any purpose except mining, a large percentage of them are now worth, for other purposes, many times the required mineral purchase price.

"Times have changed since 1866 and 1870. Then this law was of real interest only to the miner, and no one would seek to acquire public lands at such a price unless for mining purposes and mining values. Today only a small percentage of the land claimed, or for which mineral patent is asked, is actually wanted by miners for mineral purposes. So far as the real miner is concerned, the law works today just as it did in 1870. He wants the land for its mineral values; the small purchase price is neither an objection or an inducement; he doesn't want it for anything else. On the other hand, in many instances, the land is wanted for purposes and values in no way connected with mining, and the claimant is not a miner.

"It would be unfair to charge such practices to miners as a class or to the mining industry. As a matter of fact the most flagrant violations have been by men or women clearly not interested in mining."

Mr. Sherman closed his paper by comment on the features of a prospective change in the mining laws to correct the evils he had pointed out, and at the same time protect the interest of the actual miner, and suggested that it was desirable that the industry itself be given the fullest opportunity to discuss the changes and to present their views.

George E. Collins followed with "Western View of Forest Service." His paper dealt primarily on the Forest Service as it affects the prospector. He said in part: "I have probably been selected to present the 'Western View of the Forest Service,' because of my close and continued contact with the prospector, because I have no grievance with the Forest Service, and am unprejudiced in so far as a miner can be unprejudiced. I shall speak largely for Colorado because I know Colorado intimately, but I believe that the same conditions pertain in other western states.

"The largest part of the unappropriated mineral resources of Colorado are within the national forest, but on lands which are practically without timber. The act creating the national forests authorized the President to set apart lands wholly, or partly timbered; but it was not the intent to include lands which might be more valuable for its minerals, or for agriculture than for forest.

"The power delegated to any governmental officer, or department has a tendency to increase, and we can observe tendency for power to grow and words to change meaning in the administration of the Forest Service. The present policy goes beyond the intent of the laws, and the growth of unauthorized regulations should be restricted.

"The scarcity of prospectors in the Rocky Mountain region is due to special conditions and first and foremost of these is the Forest Administration. The miner should receive 'most favored nation' treatment, and not be treated as a poor relation.

"What can be done to encourage prospecting? First and foremost, revise the administration of the Forest Service from top to bottom. In giving the prospector's view toward the Service let me paraphrase a popular song—'It is not the things they do, but the nasty way they do it.' It should be the duty of all employes of the Forest Service to help and encourage the prospector, and as rapidly as possible to remove mineral lands from the national forest."

Bureau of Mines and Mining Industry

Dorsey A. Lyon changed his subject to "The Service Rendered the Mining Industry by the Bureau of Mines." He said that as Mr. Callbreath was very largely responsible for the establishment of the Bureau of Mines, he would ask him to tell what the mining industry desired of the Bureau. Mr. Callbreath gave the following as the things they had in mind in working for the creation of a Bureau of Mines:

1. The things that the mining industry could not do for itself.
2. The thought that the industry might be slighted.
3. The safety program in the industry.

Mr. Lyon then resumed. He wanted to remind the mining industry that the Bureau had no police power. They had a policy, but no power of regulation.

The Bureau's first work was:

1. Prevention of coal mine accidents.
2. The utilization of coal.

But the Bureau has grown and has interested itself in problems which confront the mining industry as a whole.

When placed under the Department of Commerce the Bureau was reorganized into three branches—technologic, economic, and safety.

The Bureau was attempting to render service in all branches, but as engineers, the men here are probably most interested in the work of the technologic branch. Justification for this work may be found in the papers by H. Foster Bain, and Dr. M. F. Coolbaugh at this meeting. The Bureau tries to avoid doing any work which the consulting engineer can do. Finally, the aim of the Bureau of Mines is to render service to the mining industry in cooperation with the industry.

The subject discussed by Max Ball was "The Small Operator's Technical Staff."

He made this a plea for more adequate support for the United States Geological Survey. This plea was made solely from the standpoint of the small operator in the oil industry. He regarded the interests of the oil industry as the interest of the public and made his plea on that basis.

The small operator has a place in the producing branch of the industry even though he is fairly well crowded out of the refining and marketing branches. He supplies an open mind and a gambling tendency that has resulted in opening of new fields.

Staffs capable of studying broad problems, or of making regional studies are beyond the resources of the small operator who must look to the United States Geological Survey and to a lesser extent to the Bureau of Mines for help. The advice of the United States Geological Survey enables the small operator to stay somewhere near his larger rivals in a highly competitive field. Mr. Ball closed with a plea for funds for the United States Geological Survey which would permit an increase in the scope of its work, and also allow better salaries for the survey men.

Mr. E. H. Denny, District Engineer, United States Bureau of Mines, spoke on "Mine Safety," with particular reference to the metal mining industry. He briefly reviewed the safety work of the Bureau of Mines and the progress made. He showed that the annual cost of industrial accidents was $1,000,000,000, and that most companies now realize that wise expenditure for safety work is a profitable investment. In his opinion 'the further wise and careful safety supervision could be carried' the better.

Resolutions Adopted

On Thursday afternoon the final session of the Western Division of the American Mining Congress was held with Hon. Jesse F. McDonald presiding. This session was devoted to a report of the Resolutions Committee and unfinished business of the convention. The following resolutions were adopted:

Resolution No. 1

WHEREAS the western land-grant states of Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, North Dakota, South Dakota, Oregon, Utah, Washington and Wyoming have been granted certain lands by the Government for the benefit of the common schools and institutions of higher education; and

WHEREAS by the terms of a number of these grants and by judicial construction and departmental rulings as to the balance, the mineral rights in the lands granted have been retained by the Government; and

WHEREAS the surface rights of much of the lands of these grants are of little or no value and contribute only in small part to the cost of education in the various states; and

WHEREAS the principal object to be attained by these grants will be defeated unless the mineral rights are relinquished to the states: Therefore be it

Resolved by the Western Division of the American Mining Congress, That the United States should relinquish to any state or territory all right, title and interest of the United States to the lands, irrespective of their character, granted to such state or territory, for the support of or in the aid of common or public schools, as provided for in Senate bill 564 of the first session of the Sixty-ninth Congress of the United States, passed by the Senate April 29, 1926, subject to the provisions of such bill.

Resolution No. 2

WHEREAS on July 1, 1925, an appropriation in the sum of ninety thousand dollars ($90,000) was made available by the Federal Government for the equipment of an oil shale research plant to be operated by the Bureau of Mines; and

WHEREAS on July 1, 1926, an additional appropriation by the Federal Government in the sum of eighty-seven thousand dollars ($87,000) became available for the operation of said plant; and

WHEREAS said plant has been completed and is ready for operation; and

WHEREAS the research problems involved in the development of the oil shale industry are numerous and difficult; and

WHEREAS said appropriation of eighty-seven thousand dollars ($87,000) is available for a period of one year only; and

WHEREAS it is believed by this organization that all of the important problems involved can not be solved within the period of one year; and

WHEREAS the oil shale deposits on the public lands have a potential value to our nation so vast as to be almost inestimable; and

WHEREAS the solving of the problems connected with the development of said deposits will improve the defensive position of the United States by providing an adequate supply of petroleum and its products in time of emergency: Now, therefore, be it

Resolved, That the Western Division of the American Mining Congress hereby expresses to both Houses of the Congress of the United States its hearty appreciation of the action of those bodies in providing the aforesaid appropriations for the research work to be carried on by the Bureau of Mines with respect to the oil shale industry; and be it further

Resolved, That the Senate and the House of Representatives of the United States be, and they are hereby, petitioned to provide such additional funds as may be necessary to enable the Bureau of Mines to continue said research work at the expiration of the year now provided for; and be it further

Resolved, That the secretary of this association be, and he is hereby, directed to furnish a copy of this resolution to the President of the United States, to the Vice President of the United States, to the Speaker of the House of Representatives, to the chairman of the Committee on Mines and Mining of the United States Senate, to the chairman of the Committee on Public Lands of the United States Senate, to the chairman of the Committee on Appropriations of the United States Senate, to the chairman of the Committee on Mines and Mining of the United States House of Representatives, to the chairman of the Committee on Public Lands of the United States House of Representatives, to the chairman of the Committee on Appropriations of the United States House of Representatives, to Hon. Herbert Hoover, Secretary of the Department of Commerce; to Hon. Curtis D. Wilbur, Secretary of the Navy; to Hon. Hubert Work, Secretary of the Interior; to Hon. George Otis Smith, Director of the United States Geological Survey; to Hon. William Spry, Commissioner of the General Land Office; and to Hon. Scott Turner, Director of the Bureau of Mines.

Resolution No. 3

WHEREAS a large part of the undeveloped mineral resources remaining in the Western States are situated on lands covered by national forests; and

WHEREAS the laws provide for free access to the national forests, as to other parts of the public domain, for the purpose of prospecting and development of the minerals thereon; and

WHEREAS there exists a widespread feeling among the miners and prospectors of the Western States that the policies adopted by the administrators of the national forests look to their permanent control by the Federal Government, and are prejudicial to the free development and appropriation of the minerals thereon as by law provided: Now, therefore, be it

Resolved by the Western Division of the American Mining Congress, That the mineral lands contained in the national forests should remain open for location, appropriation and use under the existing laws, and that the Forest Service should endeavor by all means in its power to facilitate and encourage such location, appropriation and use, subject only to such general restrictions as may be necessary to protect the woodlands and watersheds from damage and destruction; and be it further

Resolved, That in case of objection being raised, on behalf of the Forest Service, to any mineral appropriation or claim on the public domain, during pendency of proceedings for patent or otherwise, the Department of the Interior should proceed to ascertain through a referee or referees of unquestioned ability and experience, who shall demand the confidence and respect of miners and prospectors both as to their knowledge of mines and their integrity, and without expense to the claimants, the facts concerning the appropriations or claims in question, so that the rights of the locators thereof shall not be prejudiced by objection raised on behalf of the Forest Service; and be it further

Resolved, That rights of way for water, power, transport of ore and other purposes necessary to the development or operation of mines should be freely granted, subject only to such charges or to such conditions as shall be necessary to compensate for damage done or to be done to said forest, or to provide for safeguarding of the woodlands thereon; and be it further

Resolved, That copies of this resolution be presented to Senators and Congressmen representing the public-land states with the request that they cooperate to bring the intent of this resolution into actual operation and effect.

Resolution No. 4

WHEREAS the British Government for India has had for some time in contemplation the establishment of a new financial system for that great dependency to be more firmly based and established upon the gold standard, so called, and operating through a central bank with power of note issue of rupees based upon and redeemable in gold as shall be

provided instead of silver as heretofore; and

WHEREAS the said new financial system so under contemplation will, if and when it becomes effectual, largely deprive the silver reserves and coin of India of their money function, thus converting it into a commodity possessing value only as such and subject as other commodities to market fluctuation; and

WHEREAS it is proposed by the Royal Commission that to buy the necessary gold to establish the proposed gold bullion standard, approximately 700,000,000 ounces of silver now held by India to be sold over a period of 10 years, thus necessarily depressing the world price of silver below the rates prevailing since the end of the World War; and

WHEREAS more than 50 percent of American silver production constitutes a by-product in copper, zinc and lead mining, and as such serves to materially reduce the cost of production of said metals; and

WHEREAS much of the remaining silver production, owing to the constantly decreasing silver content in the ores of the silver mines still operating, affords a small and constantly decreasing margin of profit on said ores over the cost of mining and reduction, and which mines must close when said margin disappears; and

WHEREAS the people of the United States are by far the greatest consumers of copper, lead and zinc in their various industries and pursuits, the basic cost of which must increase with the increasing cost of their mining and reduction, which increase must keep pace with the falling price of silver, and which will, therefore, constitute a proportionate increase in the already high cost of living; and

WHEREAS the amount of gold which the Indian Government will require as a basis for the operation of its said contemplated future financial policy, must greatly exceed that heretofore contributed to India, which in 1925 amounted to 50 percent of the year's production, and which large amount of gold must be taken from the world supply through prices sufficient in amount to secure the same; and

WHEREAS the existing world supply of gold being none too large as a basis for the industrial, commercial, manufacturing and financial operations of the gold-using countries the purchases, which must be made for the new Indian system, will necessarily result in enhancing the value of all gold throughout the world, which will be permanent, if not increasing, because of the constant drain of the British East Indian Government upon such supply as the requirements of its new financial system will demand; and

WHEREAS there is a strong probability that the report of the Royal Commission will be adopted and become law; and

WHEREAS the far-reaching results of such a change in the monetary system of a vast country comprising nearly 500,000,000 of people inured to the use of silver as its basic currency for centuries are difficult of estimation, yet whose immediate consequences direct and remote to the other nations of the world, and particularly to the people of the United States of America, are so serious and apparently unavoidable as to arouse our just apprehension and require some expression of such protest as our Government and people would be justified under the principles of international comity in making: Therefore be it

Resolved, That in view of the conditions above outlined the Western Division of the American Mining Congress do respectfully request and petition our Government, and particularly the Secretaries of State, Treasury, and Commerce, to secure as far as may be possible, all information regarding the contemplated radical and far-reaching revolution in East Indian finance, the extent to which the same may be carried, its effect upon our own monetary system, the material welfare of our people, and particularly those directly interested in the production, refining, and manufacturing of the precious metals; and be it further

Resolved, That the Senate and House of Representatives be requested as soon as possible after the commencement of the December term of the Congress, by appropriate resolution, either to instruct their appropriate committees to make due and appropriate inquiry into the conditions outlined in this preamble and resolutions, or to appoint a special committee or committees armed with authority to make such inquiry and report to their respective Houses at as early a date as is consistent with the magnitude and importance of the subject; and be it further

Resolved, That our Government be urged to take such action as it may properly take to avoid the adoption of the Royal Commission's report, so far at least as the sale of 700,000,000 ounces of silver, or any part thereof, is concerned, and to maintain so far as may be possible the present use of silver by the people and Government of India; and be it further

Resolved, That copies of this resolution be forwarded to the President of the United States, Secretaries of State, Treasury, and Commerce, and to the presiding officers of the Senate and the House of Representatives, respectively.

RESOLUTION NO. 5

WHEREAS Senate bill No. 756, of the Sixty-ninth Congress, directs the Secretary of the Treasury, in compliance with the requirements of the Pittman Act, of April 23, 1918, to instruct the Director of the Mint to purchase of the product of mines situated in the United States, and reduction works so located, 14,589,730.13 ounces of fine silver in accordance with those certain allocations of silver and silver dollars to the Director of the Mint for subsidiary silver coinage on September 7, 1918; November 28, 1919; October 18, 1920; and December 18, 1920, and the orders to purchase the said silver contained in said allocations and each of them, respectively, at and for the sum of $1 an ounce, which bill has passed the Senate and is now pending before the Banking and Currency Committee of the House of Representatives; and

WHEREAS it is essential in order to secure the passage of said bill at the coming short term of the Congress that said committee report it to the House calendar as soon as possible; and

WHEREAS the passage of said bill is not only required by the terms of said Pittman Act, but vitally important to the metalliferous mining states of the West: Therefore

Resolved by the Western Division of the American Mining Congress in convention assembled, That the said Committee on Banking and Currency be requested to act upon said bill immediately upon the reconvening of the Congress, and that the Speaker and Committee on Rules be urged to provide for its early submission to the House for its final action thereon; and be it further

Resolved, That the Senators and Representatives of all the Rocky Mountain and Pacific Coast States are hereby respectfully urged to use all honorable means within their power to secure the consideration and passage of said Senate bill No. 756 at the next session of the Congress, and that copies of this resolution be presented to the President of the United States, the Secretary of the Treasury, the Speaker of the House, the floor leaders thereof, the chairman of the Committee on Banking and Currency, and the chairman of the House Committee on Rules, the chairman of the National Republican and Democratic Committees, and to every Representative in the Sixty-ninth Congress of the United States; and be it further

Resolved, That all boards of trade and chambers of commerce in the silver-producing states and Pacific coast be requested to memorialize the House of Representatives in favor of the passage of S. 756 at its next session.

RESOLUTION NO 6

WHEREAS the Hydraulic Mining Commission of the State of California has now in preparation a report outlining a feasible plan for the resumption of hydraulic mining in that state under the provision of the California Debris Commission act (Caminetti Act of 1893); and

WHEREAS this is a Federal act, passed in 1893, and it controls the operations of hydraulic gold mines on the Sacramento and San Joaquin River Valleys—its chief objects being the protection of the navigable channels and also farming and other lands adjacent to these rivers and their tributaries from damage by debris from the mines; and

WHEREAS under this act the California Debris Commission is empowered and directed to construct dams for the impounding of debris when appropriations have been made therefor; and

WHEREAS the plan now being formulated by the California Hydraulic Mining Commission necessitates the construction of dams by the Debris Commission, appropriations being asked from the state of California and the Federal Government; and

WHEREAS the cost of construction and maintenance of these dams will be repaid by the mines under the provisions of the California Debris Commission act, which stipulates a payment of 3 percent of the gross output of each and every mine operating behind said dams; and

WHEREAS investigations show between eight hundred and one thousand million cubic yards of gravel that would yield one hundred to one hundred and twenty-five million dollars by the provision of five dams; and

WHEREAS the engineers of the California Debris Commission are now engaged in estimating the capacities and costs of the said dams for the information of the California Hydraulic Mining Commission and of the Federal Government, which costs will not exceed $10,000: Now, therefore, be it

Resolved, That the Western Division of the American Mining Congress records its desire to assist the citizens of California in the solution of this important economic problem.

RESOLUTION NO 7

WHEREAS the Department of the Interior has indicated, through its Secretary, that it will ask for the repeal of

the 640-acre or stock-raising homestead act; and

WHEREAS well-known mineral areas have been thrown open for entry under said act, and many stock-raising homesteads have been granted upon mineral lands; and

WHEREAS even though the provisions of said act provide for the prospecting for and mining of minerals contained in the areas covered by the said stock-raising homesteads, in practice the effect of said act is to eliminate the lands so entered from any further mineral development; and

WHEREAS the entering of stock-raising homestead entries upon mineralized areas has curtailed, if not entirely stopped, all mineral development in said areas: Now, therefore, be it

Resolved by the Western Division of the American Mining Congress, That we endorse the suggestion of the Secretary of the Interior that the act be repealed, and if the act is not repealed, but amended, that it be so amended that all areas known to be mineral in character, but otherwise subject to entry under said act be permanently withdrawn from entry thereunder, and that on all other lands entered and patented under said act the mineral rights shall pass to the patentee in fee.

RESOLUTION No. 8

Resolved, That the Western Division of the American Mining Congress favors united action of all public-land states on all questions particularly affecting the common welfare of such states and their inhabitants, and extends to such movements the use of its organization and facilities for the perfection of the necessary machinery to secure such united action.

RESOLUTION No 9

WHEREAS many charming courtesies and a most generous display of hospitality have been extended to the members of the Western Division of the American Mining Congress, the American Silver Producers' Association, the American Association of Petroleum Geologists, and the American Institute of Mining and Metallurgical Engineers in convention assembled in Denver, September 20 to 24, 1926, by the various individuals and organizations who have acted as hosts during the named convention; and

WHEREAS such courtesies have been greatly appreciated by the recipients thereof, and it being the sense of this joint convention that some acknowledgment be made of such now: Therefore be it

Resolved, That it be the sense of this meeting that a vote of thanks be extended to those who prepared and presented addresses before the meeting, to the reception and the entertainment committees, who have so generously and thoughtfully cared for our needs and added to our pleasures during the several days of the convention, and, furthermore, we desire through said committee to thank the public press, the various regularly constituted organizations, and the private individuals who gave so liberally of their time and their means toward our comfort and entertainment; and be it further

Resolved, That this resolution be spread upon the minutes of the Congress and that a copy of the same be sent to each of the Denver newspapers with a request for publication.

RESOLUTION

WHEREAS the proposal inaugurated by Mr. F. G. Bonfils, proprietor of the Denver Post, for a League of Rocky Mountain States to promote the economic welfare of the intermountain territory and to encourage the development of its natural resources has attracted widespread and favorable attention: Therefore be it

Resolved, That the Western Division of the American Mining Congress heartily endorses the suggestion for a League of Rocky Mountain States properly organized for the purpose of securing united action on all questions, particularly affecting the common welfare of the states included in the intermountain territory.

ENTERTAINMENT FEATURES UNUSUAL

As a host, Denver lived up to the high standard of Western hospitality. Beginning Monday evening there was concurrently held a smoker and get-together meeting for the men and a reception for the visiting ladies. Entertainment was furnished by a "Frontier's Day" string quartet and by an excellent vocal quartet. Dancing began at 9.30 in the Colorado room of the Cosmopolitan Hotel, where a reception was tendered to the delegates by the mining men of Denver.

On Tuesday afternoon the visitors were taken to Golden for an inspection of the experimental mill at the Colorado School of Mines. From there delegates were taken to Indian Hills for a genuine elk barbecue. Three hundred and twenty-five people were served a very excellent barbecue supper out under the pines. At Indian Hills an Indian Pueblo has recently been built. This is an excellent reproduction of the Pueblos of New Mexico. After the barbecue visitors were taken to the Pueblo and entertained by ceremonial dances by the Indians who were from the Pueblo of San Juan, N. Mexico. Chief Evergreen Tree gave his wonderful imitation of the call of birds and beasts of the forest. This was followed by dancing at the Indian Hills Clubhouse. This unique and delightful entertainment was through the courtesy of the Mining Bureau of the Denver Chamber of Commerce and the Colorado Mining Association.

A trip to Fort Collins oil fields was arranged for the members of the Association of Petroleum Geologists and a trip was also made to the Government Oil Shale Plant at Debeque, Colo. A special bridge tea under the auspices of the Women's Auxiliary of the American Institute was given Wednesday at the Cherry Hills Country Club.

A luncheon was also given to the visiting ladies under the auspices of the Petroleum Geologists ladies at the home of Mrs. T. S. Harrison.

A number of the papers presented to the joint convention will appear in full in the November issue of the MINING CONGRESS JOURNAL.

Courtesy U. S. Geological Survey

Smuggler Mill, Telluride, Colo.

The General Land Office will open to entry on December 10 at the Salt Lake Land Office, 14,946 acres of land in San Juan County, Utah, on which slight indications of oil seepage have been noted on some of the land on the breaks of San Juan River Canyon; and another tract of 23,000 acres, on a part of which there is an oil-drilling prospecting outfit.

The old Morey mines are located in a section of 15,771 acres of land in Nye County, Nev., which will be opened to entry December 16 at the Carson City land office.

In addition to oil shale, there are other indications of oil in 12,843 acres of land in Sweetwater County, Wyo., which will be opened to entry January 27 at the Evanston land office.

Some copper ore and placer gold has been noted on 23,185 acres of land in Pima County, Ariz., which will be opened to entry December 30 at the Phoenix land office.

The Midwest Oil Co. is carrying on extensive development work and there are two producing wells in 23,000 acres of land in Sublette County, Wyo., which will be opened to entry January 27 at the Evanston land office.

OUR PUBLIC LANDS QUESTION*

A Principal Question Is Whether United States As Central Administrator Or Segregated States Operating Independently Should Administer Public Lands—Repeal Of Stock Raising Homestead Act, Desert Land Act, And Establishment Of Grazing Districts Advocated

By HON. HUBERT WORK †

AS an administrator of the public lands I must take a national viewpoint rather than be influenced by my previous environment and my long association with those having closest contact in the development of these remaining natural resources, which have been regarded from the creation of the nation as the property of all the people.

It is not my purpose to forecast the action of the Congress, an independent branch of the Government, or at this time to advocate a reversal of the Government's present policy in its entirety, but to open the subject up for discussion.

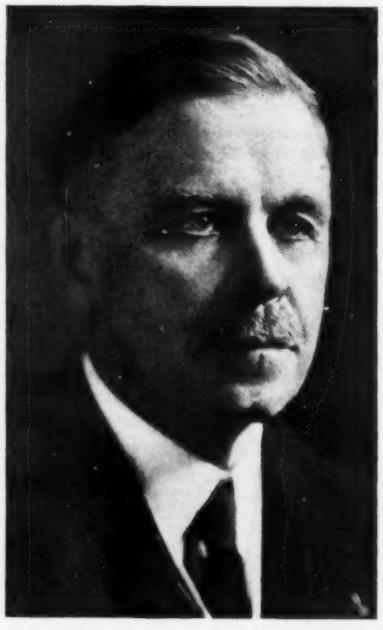
The marvelous history of the expansion of the United States and the development of its natural resources tell the story of the disposition by the Federal Government of its public lands.

The time has now come, I believe, to take an accounting of what remains of the nation s public domain. Vacant and unappropriated public lands, exclusive of territorial possessions, national forests, national parks, and other reserved areas, comprise but 200,000,000 acres. This known total includes now 14,432,940 acres discovered over a year ago by the present Commissioner of the General Land Office, which resulted from errors in the Government's land statistics. The old system of contract surveying for the Government, abandoned in 1910, was responsible for endless inaccuracies and recurring annoyances.

Of the remaining public domain, 143,000,000 acres have been surveyed, while 57,000,000 acres remain unsurveyed. These lands are no longer valuable for agricultural purposes. What remains is chiefly grazing country.

There has been no revision of our national land laws to meet these changed conditions. The Federal Government is still throwing open to homestead entry large areas of land, the character of which make the homesteading of them impracticable. Yet our citizens are being invited to waste their time and savings in a fruitless enterprise.

The principal value of the remaining public domain, however, is the untold wealth of its mineral contents. While much of the gold, silver, copper, lead, and zinc lands, once owned by the Government, has passed into the hands of private individuals, there are undoubtedly large deposits of these ores remaining in the public domain. The states of Colorado, Wyoming, Montana, Idaho, Utah, Nevada, Washington, Oregon, and California still contain areas in which are metalliferous ores, the quantity of which is unknown. There are also at the present time hundreds of thousands of mining claims located on public lands



Hubert Work, Secretary of the Interior

throughout the West which are being held by annual assessment work.

The Federal Government assumes little responsible relations in mining these ores but is now cooperating in their discovery. These minerals can be mined by individuals, oil and coal can not to advantage. The prospector has become a geologist or associate one, but wildcatting is being prosecuted continuously leading to the conclusion that much petroleum still remains in the public estate uncaptured, the exact amount of which is not ascertainable. There are also large quantities of natural gas.

It is estimated that the public lands contain 200,000,000,000 tons of valuable coal deposits, 8,000,000,000 tons of phosphate; and oil shale from which 60,000,000,000 barrels of oil may be ultimately produced; while water, the irreplaceable mineral, gathered annually by the land, has a potential value beyond estimate.

Congress in 1920 adopted a new policy covering the mineral contents in the nation's public lands. This was the so-called mineral leasing act, often referred to as the outstanding public land legislation of the century. It did not apply, however, to mining of gold, silver, copper, lead, zinc, and other metalliferous ores found on public lands, no change having been made in the existing laws applicable to their development.

The law assumed that the people hold a continuing interest in our natural resources. Under its terms these mineral rights are leased, instead of sold outright, and the Government receives a nominal royalty on all minerals produced.

Royalties to the Government as a result of this new mineral leasing policy are large in the aggregate. Oil and gas land, the title to the minerals of which are vested in the United States, returned $8,384,718 in royalties last year.

The Government's royalties from coal totalled $236,710.

From potash leasing it collected $5,037. As compared with receipts from minerals on the public domain, the Government received $733,648 from public land sales last year and $753,235 from the sale of timber on the public domain.

The general impression prevails that these royalties from mineral leasing and receipts from public lands go into the Federal Treasury to reimburse the Government for the cost of administering them. This is erroneous.

Under present laws 37½ percent of the royalties and 5 percent of the net proceeds from sales of public lands are turned back to the state governments in which the public lands are located.

Fifty-two and a half percent of the royalties and approximately 60 percent of the receipts from the disposal of public lands are diverted to the Reclamation Fund to be used in the West, while only 10 percent of the royalties and approximately 35 percent of the land receipts revert to the United States Treasury.

Last year the United States Government received only $842,845 of the total collected from oil and gas royalties, while $3,142,447 was returned to the states and $4,399,426 was turned over to the Reclamation Fund.

From coal royalties $23,671 was paid into the Federal Treasury, while $88,-

*Paper presented to Annual Meeting, Western Division, American Mining Congress, September, 1926.

†Secretary of the Interior.

766 went back to the States, and the Reclamation Fund received $124,273.

Of the $5,037 from potash, the National Government received none, the entire amount being paid into the Reclamation Fund.

Sales under the Timber and Stone Act brought $76,507 to the Federal Treasury, while $3,187 was returned to the states.

Of the receipts from the disposal of public lands $578,783 went into the general treasury last year, $565,000 being paid into the Reclamation Fund, and $25,000 returned to the states.

A new proposal is now being advanced with regard to the nation's public estate. When legislation was passed which enabled western territories to enter statehood, the Government retained ownership of the public lands. The land laws as now administered have been in effect over half a century and have been sustained by the Supreme Court of the United States when attacked. Outspoken demands have been made that publicly-owned lands should be "returned" to the states wherein located.

Our public lands never were owned by states and, therefore, were not taken from them. In 1787 the Confederate Congress passed an ordinance establishing this fundamental policy for the Government of the territory of the United States northwest of the Ohio River. I am quoting the exact language of the ordinance dealing with this question:

"The legislatures of those districts, or new states, shall never interfere with the primary disposal of the soil by the United States in Congress assembled, nor with any regulations Congress may find necessary for securing the title of such soil to the bona fide purchasers."

As already shown, Virginia, when it entered the Confederacy, released its claim and donated to the nation the entire central section of the United States north of the Ohio River. To give to states the public land within their boundaries would be a complete reversal of the policy of this Government from its beginning, a precedent not set by any other nation, and a step which should not be inadvisedly taken.

Five years in the midst of Government operations have convinced me that the Federal Government is administering more, and the states less, of the activities of Government than they should. It would be agreeable to recommend from an administrator's point of view that states might own and control the public lands. That would, of course, relieve the Government of the labor and expense of administering them and would relieve the taxpayers of an annual deficit in its net operating expenses.

The Department of the Interior expended last year the sum of $2,949,337 for the administration of the public domain, $2,370,170 of which was spent by the General Land Office and $579,167 by the Geological Survey.

It collected $9,844,831, exclusive of Indian land sales, and other public land areas administered under special acts of Congress. Of this amount $3,221,604 was paid back to the state governments and $4,979,547 was diverted to the Reclamation Fund to be used in the reclaiming of arid and semi-arid lands of the West.

This leaves an unencumbered balance amounting to $1,643,680 actually placed in the United States Treasury last year to offset the Federal Government's expenditures of $2,949,337.

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*"The Federal Government is administering more, and the States less, of the activites of the Government than they should. * * *"*

*"For the Government to give to the various States the public lands located in those states is entirely against the principles of Government. * * * These lands cannot be "returned" to the States because the States never owned them. * * *"*

*"Whether there shall be a change of policy in the Public Land Laws is a question of National importance. * * *"*

*"Public lands of the West and the natural resources found in them are regarded by the people of the East as property of the entire United States held in reserve. * * * *"*

The net deficit or loss to the Federal Government in administering the public lands was, therefore, $1,305,657. If the state governments should take over the public lands within their borders, and distribute the receipts as prescribed by present Federal laws, they would be compelled to pay this deficit now met by the United States Treasury. As far as the National Government is immediately concerned financially it would be an advantage to turn the remaining public domain over to the states.

But what would probably become of the public lands and their resources if administered by states? This question can best be answered by asking what has become of public lands already released to them. Many of you men can answer that question from your own personal knowledge.

The actual title to the mineral contents of these lands would pass from the Federal Government to the states to be disposed of as these states see fit. It is claimed by some of the states that at the present time whenever sales of former public lands are made that the states are reserving minerals. In Colorado, all such land contracts reserve these minerals to the state, but when it is asked how the state purposes to handle them in the future, there is no answer. The states east of the Mississippi River regard the public lands of the West and the natural resources in them as the property of the United States, in reserve.

The principal question now is whether the United States as a central administrator, or segregated states operating independently under different state laws, would be the better agency to administer the remaining public lands and their mineral deposits. Which would be the least vulnerable to local influence lending themselves to their disposition by transfer at less perhaps than their potential worth? Would any state having public lands prefer to administer them and pay the Government royalties instead of the Government administering and paying the royalties to the states? How many of our newer states could actually afford to own and administer the public lands within their boundaries? Their net financial income is greater now than if they themselves administered them.

The mineral industry is vitally interested in whether the remaining public lands with their mineral contents are administered by the National Government or by the states. Within each state there would then be a different law with which applicants for mineral leases would have to comply. This would result in a multiplicity of laws with which mining industry would have to contend, instead of one law applying everywhere. Some prospectors have already expressed alarm over the development of such a situation. I present this phase of the situation for the consideration of miners in the Western country whose interests are directly affected.

Last winter some 14 different bills were introduced into Congress, seeking to have released to the Western states, ownership of the minerals in the lands set apart for educational purpose, known as school lands. This was a demand for radical change in the present national land policy, which retains title to all minerals in the United States Government. The diversity of phrasing of these bills, with argument adduced in support of them, would indicate that the framers were not clear on the history of public lands or of mineral leasing.

Grants of public lands to states for school purposes by the Federal Government have been liberal, if not prodigal. A total of 49,276.283 acres has been given to states composing the Western group, which includes Arizona, California, Colorado, Idaho, Montana, New

Mexico, Oregon, Utah, Washington, and Wyoming. When these states were admitted to the union the enabling acts with one or two exceptions, provided that they should receive from one to four sections of each township of public lands when surveyed. It was specifically stipulated, however, that all sections known to contain minerals at the time of their proposed transfer should be retained by the Federal Government and the states should be permitted to select other lands in their stead.

Since 1850 this national policy dealing with school land grants to states has been in force. During the last session of Congress, legislation was presented to reverse this policy and to transfer mineral rights in their entirety to the states. The Jones Bill, which was used to stir up the teaching fraternity last winter, particularly of Colorado, provided for the outright gift of all minerals to be found in school sections to the states for their school funds.

Here again as far as economy of administration is concerned, the outright transfer of the minerals in school lands to the states would be advantageous to the Interior Department. Recently there were 1,760 of these school sections in Western states in dispute. Settlement of the question of whether school sections contain known minerals at the time of their transfer to states involves heavy costs. Examiners of the General Land Office must inspect each of them. Geologists of the Geological Survey must examine them. Reports must be prepared and written testimony taken.

When the states contest the findings of the Department, hearings on each individual school section must be held in the local land offices. Should the decisions of these offices be against the states, there are appeals in many instances to the Commissioner of the General Land Office and to the Secretary of the Interior. This means further expense, the amount of which it is difficult to estimate. The states in some cases go into the courts to prevent the retention in Federal ownership of school lands, the mineral content of which is questioned. Costs of trials, appeals and other features of litigation, run into large sums.

If the Interior Department could be relieved of the expense of investigation, administration and litigation of mineral contents of school sections I do not doubt that the recent reorganization of the General Land Office, which resulted in the reduction of annual operating costs of approximately $600,000 annually, could be continued further and the services of a large number of additional employes dispensed with. This would mean a large saving to taxpayers in administrative costs.

Since 1920, when the Mineral Leasing Law went into effect, up to the present time the actual receipts from school sections containing minerals so far recovered by the Government only total around $30,000. Of this amount 37½ percent or $11,250 has been paid back to the states, and 52½ percent, or $15,750 to the Reclamation Fund, leaving but $3,000 for the Federal Treasury to offset the heavy expenses undergone in reinvesting the title of these minerals in the United States. Even had these school sections with the minerals been transferred to the several states and leased by them, additional income to the states would have amounted to only $3,000 in six years.

But the chief concern of the states evidently is in obtaining possession of the minerals for their future potential value. As the remaining public lands are surveyed and new school sections pass to states, there is a possibility that some of them may contain rich oil, gas, coal or other mineral content. In a section and one-half located in Utah, now the subject of litigation between the Federal Government and the state, valuable deposits of coal have been found. A lease has already been made by the Interior Department, which the Geological Survey estimates, will bring royalties of $30,000 annually for a period of from 17 to 20 years. Recently I appointed a committee of Interior Department officials to expedite the settlement of the question of mineral contents in 1,760 school sections then in contention between the Government and the states. The committee has already made findings and recommendations in nearly 400 cases. These cases have involved lands alleged to be valuable for coal, oil shale, gilsonite, asphaltum and gold. In accomplishing this result the committee has had to read and consider hundreds of pages of testimony, reports of mineral inspectors, maps, plats of survey, records of the General Land Office relating to status, and official bulletins of the Geological Survey. In a group of consolidated cases now under consideration by the committee, involving about 160 sections, there are nearly 4,000 pages of testimony, as well as numerous other exhibits, all of which must be read and considered and recommendation prepared as to each section involved. A very material advantage from the appointment of this committee should be a general harmony of reasoning and conclusions.

Another feature of the situation is that title to these school sections after they have been transferred to the states is uncertain. Because existing law makes no provision for the issuance of a patent or evidence of title by the Federal Government to the states, I have recommended to Congress that patent should issue to the states for all lands in place not known to be mineral at the date of approval of survey or when otherwise the right of the state would attach. In case school sections are mineral in character, the states are already allowed to select other lands in place of them. I believe also that the law, in order to expedite adjustment of the grants, should require that action by the Government be taken to determine the character of the land within a limited period, six years from the date of the new law, or in future, six years from the date of the approval of the survey. Failure of the Government to protect its rights, title should pass unencumbered to the states.

Whether there should be a fundamental change of policy involving this great public trust is a question of national importance and not alone of local interest. The outright gift of the minerals in the school lands granted to the states means a permanent release by the United States of natural resources that belong to all the people of the country. No right or claim of the states seems to justify the gift of these minerals, and only Congress is vested with the power to give them away.

In accepting your invitation to attend this convention I pointed out that revision of the public land laws was necessary. The days of pioneering have passed. Yet the General Land Office is still administering statutes that were enacted to meet pioneering conditions. We are now conducting an exhaustive inquiry with a view to recommending changes in land laws to Congress when it meets next December.

Among changes that we believe should be made is the repeal of the stock-raising homestead act. Areas on the public domain adaptable to stockraising in quantities of 640 acres have been appropriated. Any lands now open to entry under this law invite failure and disappointment to citizens who attempt to homestead them. Whatever purpose this law may have served in the past, its usefulness is now at an end.

The Interior Department is compelled under present statutes to throw open to homestead entry all areas of public lands when surveyed. As already explained, the remaining lands are not suitable for agricultural development except in isolated areas. To invite our citizens to settle upon them is unwarranted. Three years ago I advised ex-service men of the World War not to attempt to homestead public lands thrown open by the Government. After paying the expense of travel, location and improvement of homestead tracts, it was found that the savings of these men were wasted in a futile effort to make a farm on public land unfit for (*continued on page* 762)

RELATION OF PUBLIC LAND STATES TO THE FEDERAL GOVERNMENT*

Unreserved Public Lands Approximate 184,000,000 Acres, 97 Percent Of Which Is In Eleven Western States—Leasing Act Repeal And Ceding Back All Public Lands To Respective States Advocated—Elimination Centralized Power In Washington, And Bureau Government, With Equal Equality, Dignity And Authority All States Necessary

By HON. CHARLES E. WINTER†

IN this discussion, I am not here to criticise the administration of the public land and mining laws. Naturally, the states in which public lands lie, and the individual citizens of such states, desire and contend for the most liberal interpretation and administration of mining and land laws for the benefit of such states and their people.

I am deeply interested in principles, policies and legislation. What I have to present will be to the end of arriving at a common understanding and purpose to be followed by united action in securing legislation determining and fixing future policies in the interests of the public land states. In the long view, I profoundly believe that what is best for these states is best for the nation; because equity and justice make for the good of the whole. Inequity and injustice create conditions that harm the whole infinitely more than any temporary material or money gain to the Treasury of the United States, or the exercise of national power.

Let us review very briefly the history and present status of the public domain. Excluding our island possessions and Alaska, the total area of the United States is 1,937,000,000 acres. Of this amount, 400,000,000 comprise the original 13 colonies or states. There remained 1,537,000,000 acres to be "disposed" of by the national Government under the Constitution and under the policy determined in our early history. Two hundred and two million acres, not including grants for benefit of state railroads, wagon roads and the Carey act, were granted to the states upon or subsequent to their admission. In addition thereto, there were granted to the states 37,000,000 acres which in turn were granted by the states to railroads. The average amount of land granted to the present 11 public land states for all purposes to date is 6,084,378 acres. This, on the average, is about one-tenth of the area of each state.

The Government has disposed, by subsidy, sale or homestead, of approximately 1,053,000,000 acres and has received into the United States Treasury from this source, in round numbers, $566,000,000. It has received in mineral royalties about $50,000,000 since February 25, 1920, under the Leasing act.

Let us in the light of this history view the present status. There remain 184,000,000 acres of unreserved and unappropriated public land. Ninety-seven

Charles E. Winter

percent of this is in the 11 western states. There have been permanently reserved, by the Government, in Indian reservations, national parks and monuments, power sites and forest reserves 180,000,000 acres: Indian reservations 25,706,000 acres; national parks, 8,365,000; power sites, 700,000; forest reserves, 136,000,000 acres. In addition to this, there have been granted permits and leases under the General Leasing act of 1920, about 45,000,000 acres. This area, strictly speaking, is not withdrawn from entry, provided the surface is not necessary to the extraction of minerals. In round numbers again, the acreage withdrawn permanently from settlement or acquirement by private ownership is 200,000,000 acres. In this I am assuming that 45 or 50 million acres under permits and leases may ultimately be settled as to the surface and therefore exclude them. We are today concerned with this 200 million acres forever reserved under the present policies and laws, and with the remaining 184 million acres of the unappropriated and unreserved public lands. Inasmuch as there is a well defined movement, crystallized into bills now pending before Congress, to place the remaining 184 million acres on a lease or rental, or grazing fee system, abolishing the free range, and to repeal or make inapplicable the 640-acre stock-raising homestead law, we are face to face with the question whether not only the areas heretofore reserved, but a total of 400 million acres of the area of the present 11 public land states is never to be settled, never to pass to private ownership, or made taxable, but is to ever remain under the Federal Government as a perpetual landlord.

For one, I am utterly opposed to this condition and this idea. If the area reserved were limited to parks of reasonable size, and small monuments and even the Indian reservations, we could and would agree and acquiesce. But the area thus proposed to be forever withheld from the states and private ownership comprises an average of 55 percent of the whole area of each of the states of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Nevada, Utah, California, Oregon and Washington. I maintain that such a condition can not permanently endure. These states can not develop and live half state and half national as to their land areas. A perpetual condition of half local and half Federal sovereignty simply can not be contemplated as to any state or states in this Republic. Imagine the consternation of the eastern states were it even proposed that the Government acquire more than half their areas. Such a status is foreign and antagonistic to our basic principles, and to our organic law. It is subversive of the American system provided by the Constitution. Under our structure of Government, every one of these states is entitled to now have and certainly to eventually come into absolute and full sovereignty

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† United States Congressman from Wyoming.

over every foot of soil within their borders.

The International treaties, the ordinances of 1887 and the Constitution all require and expressly provide that the area acquired under the treaties with Great Britain, Spain, France and Mexico, shall be formed into free independent states "upon an equal footing with the original 13 states." The 11 public land states have not been upon an equal footing such as was expressly provided for; we are not now on an equal footing with the original states or any of the other states and if Government Federal control is to continue indefinitely and increase instead of diminish, we never can, or will be, upon that parity or equality with the original states or with the rest of the other states of the Union. This is a clear violation of the intent, express purposes, provisions and stipulations, and of the policy of this country in force for a hundred years.

All of the states, except the present public domain states, have come into full sovereignty to the same full degree as the original states by the "disposition" of all their lands by purchase or homestead. The present public land states never can, under the present laws and policies, attain such sovereignty. We are now definitely and permanently, unless we change our laws and policies, deprived of that possibility. Some elements of discrimination have already caused us losses which are irrevocable.

I will pass over and not discuss an early theory which can be strongly supported in the international treaties, ordinances and the constitution that the Federal Government had authority to govern the territory only so long as it remained territory, and that the instant a state was admitted into the Union, it became absolute in ownership and sovereignty of every acre within its confines. I can not, however, refrain from this one suggestion on this constitutional argument in behalf of the states. The United States Supreme Court, in *Kansas* vs. *Colorado*, 206 U. S. S. 55, analyzes section 3 of Article 4, which in part is as follows: "The Congress shall have power to dispose of and make all needful rules and regulations respecting the property or territory belonging to the United States."

I emphasize as exceedingly significant the concluding part of that section: "And nothing in this constitution shall be so construed as to prejudice any claims of the United States or of any particular state."

The court says of that section that it is limited and purposely guarded by the 10th amendment which reads:

"The powers not delegated to the United States by the Constitution nor prohibited by it to the states, are reserved to the states, respectively, or to the people."

There never was in the constitution anything which could even be construed as saying that a state when admitted would not have ownership and control of the soil within its boundaries. The natural assumption and logical conclusion would be that it was therefore a right reserved to the state and the people—just such a right as *was* held and *was* exercised by every one of the 13 original states, with which we were to be on an equal footing. Ownership of the soil which is ordinarily a necessary attribute of sovereignty was not in the constitution "prohibited by it to the states"; nor was the right of the Federal Government to hold and dispose of the land of an admitted state among the "enumerated powers" "delegated to the United States." Our Supreme Court in the Kansas-Colorado case referred to, says: "All powers of a national character not delegated to the national Government by the constitution are reserved to the people of the United States."

"Excluding our island possessions and Alaska, the total area of the United States is 1,937,000,000 acres. Of this amount 400,000,000 acres comprised the original 13 colonies. There then remained 1,537,000,000 acres to be disposed by the National Government under the Constitution. Two hundred and two million acres, not including grants for benefits of state railroads, wagon roads and the Carey act, were granted to the states upon or subsequent to their admission. The average amount of land granted to the present 11 public lands states for all purposes to date is 6,084,378 acres. This, on the average, is about one-tenth of the area of each state. The Government has disposed by subsidy, sale or homestead of approximately 1,053,000,000 acres, and has received in the U. S. Treasury from this source $566,000,000. It has received in mineral royalties about $50,000,000 since February 25, 1920, under the leasing act."

I will say here, that the right of the United States to *acquire* territory by purchase or conquest and to hold and govern the same as long as it remains a territory is clearly inherent in the express provision of the constitution empowering it to make treaties, and the express provision to govern territory. On this basis, there is no doubt that the nation constitutionally acquired the areas from the different nations and held and governed them as territories. The question arose at the time of the admission of the territories as states. I am not here following that inquiry further. I call your attention to this as a background lying deep behind our present problems.

Passing that proposition, we find the theory under which we have operated for a hundred years stated by our Supreme Court in this language in *Pollard* vs. *Hagen*, 3 Howard, 212, decided in 1845: "Whenever the United States shall have fully executed these trusts, the municipal sovereignty of the new states will be complete throughout their respective boundaries and they and the original states will be upon an equal footing in all respects."

The trust referred to is that which the United States has been exercising as to the public lands. No one contends or ever has, that the United States has municipal sovereignty or actual ownership in its own right within any state except that it gained the same by compliance with Article 1, section 8, paragraph 17 of the Constitution which defines the manner in which, excepting the District of Columbia originally provided for, it can acquire such right within a state, to-wit: By purchase and by the consent of the legislature of the state in which the property or area shall be. The court further analyzes the trust and the duty of the United States as follows:

"Taking the legislative acts of the United States and the states of Virginia and Georgia, and their deeds of cession to the United States, and giving to each separately and to all jointly a fair interpretation, we must come to the conclusion that it was the intention of the parties to invest the United States with the eminent domain of the country ceded, both national and municipal, for the purposes of temporary Government, and to hold it in trust for the performance of the stipulations and conditions expressed in the deeds of cession and the legislative acts connected with them. * * * When the United States accepted the cession of the territory, they took upon themselves the trust to hold the municipal eminent domain for the new states and to invest them with it, to the same extent in all respects that it was held by the States ceding the territories. * * *."

Henry Clay said: "The General Government is a mere trustee, holding the domain in virtue of those deeds, according to the terms and conditions which they expressly describe; and it is bound to execute the trust accordingly."

All agree from our earliest history that even under the compacts with the state whereby the states waive or cede their rights to the public lands and agree that they will not interfere with the primary disposal of the soil, all

constitute the United States a trustee. That trust has been fulfilled as to all the other states finally except the present public land states. It has been fulfilled by gradually "disposing" of the lands until every acre came into private ownership and under taxation by the states. But when it comes to the Rocky Mountain and western states, what do we find? We find that under a new policy to which all the rest of the states were never subject, the Federal Government, through Congress, has permanently withdrawn from the process of settlement and placed beyond the power or possibility of ever coming into private ownership and helping to sustain a sovereign state, 200 million acres. This is for various alleged national purposes, for Indian reservations, national parks and monuments, power site reservoirs, forest reserves and, in effect, all coal, oil, oil shale, phosphate and sodium areas under the General Leasing law; and now it is proposed to legislate so that all the balance of the public domain, 184 million acres, shall be precluded from settlement or any acquirement by private ownership.

The United States, by the aforementioned withdrawals which have actually been made and are in force, has not only withheld them from the states and the people of the states who are the rightful beneficiaries of that trust, but since 1902 it has been exacting rent from the forest reserves and since 1920 a royalty from the minerals enumerated in the General Leasing bill, and has retained the bulk of these revenues. It has repaid to the said states only 25 percent of the forest grazing fees, plus 10 percent for roads, and but 37½ percent of the royalties. The rights of the states of production to have any return, save a paltry 5 percent from the proceeds, from the sales of public lands, was belatedly and partially recognized when the reclamation fund was established in 1902. But even as to this fund, great and important and beneficial as reclamation is, it is not a return of the money to the state. The 52½ percent of the proceeds of public lands and royalties which goes to the reclamation fund is a loan and not a refund. The settlers must repay. It aids in development and settlement and helps to create taxable wealth in the land and improvements, but lest we forget, let it be realized that it is a loan and not a repayment; a loan without interest it is true, but nevertheless a loan on the proceeds of royalties and the sale of our lands and not a return of the money to the state. Incidentally, lest we forget another phase of this matter, the 26 states existing in the year 1836 divided up the proceeds of the sales of public lands amounting to 28 million dollars, calling it a loan. Nevertheless, while the representatives of these same eastern states criticise the settlers on the reclamation projects for not paying up promptly in full each year the amounts stipulated under their contracts, the eastern states receiving those loans in 1836 have never repaid a dollar, either of principal or interest. It stands on the books of the Secretary of the Treasury as "unavailable funds."

National Parks and Indian Reservations

So far as I am concerned, I am entirely willing to let this invasion or withholding of the rights of the public land states stand as to the national parks, although they have now increased to the number of 23 or 24, and set apart from all development or taxation nearly 10 million acres. We probably would not change the Indian reservations. These areas are used directly for broad national purposes and are probably best administered by the Federal Government. My judgment is, however, that with the adjustment and enlargement of the lines of the national parks under the bills introduced in the last session of Congress, we have reached the limit of proper park reservations and the states should vigorously oppose any further enlargements, or the creation of more parks in the public land states.

> ***"There remain 184,000,000 acres of unreserved and unappropriated public lands. Ninety-seven percent of this is in the 11 western states. There have been permanently reserved by the Government in Indian reservations, national parks and monuments, power sites and forest reserves 180,000,000 acres. In addition to this, there have been granted permits and leases under the general leasing act about 45,000,000 acres."***

Forest Reserves

For the last 25 years, the forest lands of the western states have been under national laws, under a conservation policy. They have been added to year by year, and are still seeking enlargement, although, exclusive of Alaska, there are now 136 million acres in national forests administered by the forest service of the Department of Agriculture. No one in this day will take a stand in opposition to the conservation idea. No one would attempt to combat the principle. I do not. Let us all agree that conservation means not only the preservation but a proper use of the timber resources and the lands and other natural resources contained therein. Even the Federal view and the policy of the law, theoretically, at least, is to develop and utilize to the fullest extent consistent with forest preservation. Why was it necessary to create the national forests? To preserve a proper amount of timber in the mountains and watersheds, to hold the snows and moisture and to prevent wholesale denudation and subsequent erosion; to regulate, as far as possible, the flood-waters, for the retention of the great quantity of snow and the absorption of the rainfalls.

Abuses in the use of these timbered areas began in the older states and carried on in some of them to destruction. Incidentally, I might insert here the observation that whereas our forest lands are retained from our states and revenues returned only in part, that we, as taxpayers, are called upon to pay money into the United States Treasury out of which the forest service under the national forest commission is purchasing back forests or forest areas which have passed into private ownership and taxation in the eastern states.

Proper conservation is both good and necessary. I propound the question, however, startling as it may seem—Why can not the states administer the forest areas within their boundaries as well as the Federal Government? Is this iconoclastic? Is it lese majeste? No, it is simply getting back to first principles. Let us see. These areas have been public lands and the Government controlled them. The abuses which created the necessity for national forest reservations occurred under that same government supervision under national laws. It is a habit with certain eastern-minded citizens, whose states have had and used all their resources and now want to share ours, on that fine principle—"What's mine is mine: what's yours is ours"—and the departments have been inoculated with the same virus, to say that the states are improvident; that they permit waste; that they sell immense valuable areas far below their value; that corrupt politics will favor certain henchmen and supporters with grants and sales and leases at less than their worth. Texas worked out a sales and a lease law and handle their own lands. Will anyone contend that in the past the Federal Government has not been improvident—that these things have not occurred under national administration? In this day and age, the states and the people of the West are just as anxious and determined as any state and their citizens anywhere, to conserve all of the forests and other resources. They do not believe in wasting them. They, themselves, are the first beneficiaries of true conservation and they would be the first victims of a contrary policy.

Where the states in the past have wasted resources on a small scale, the

nation has done the same on an immense scale. The fact is that in earlier years, both the nation and the states did not know or realize the immense values which the development of after years disclosed. We were all educated in the same way at the same time. Should it be possible for the states to be given the forest public land within their confines, there is no reason to believe or say that they could not and would not administer them under provisions for the greatest good to the greatest number. The fact is that the states are now keen in looking after these valuable interests, and in some, the constitution retains all mineral rights when land sales are made. The western states should have this right the same as all other states have had. They should have the right to develop the untold resources which undoubtedly lie in the forest areas of mineral wealth as well as the annual growth of timber — just as all other states have had.

While mining locations are permitted in the national forests, the conditions and restrictions do not encourage but discourage the prospector and miner. And if it be proper to charge the live-stock industry grazing fees and to exact royalties upon coal, oil, oil shale, sodium and phosphate, to which list potash has now been added, then let the states own and lease and receive directly for themselves all of such returns and not a minor portion of them. It may not be soon, but I look for the day to come when, following the original plan of this union, pursuing the American form of Government, the states will come not only into bare jurisdiction as now over the forest lands for purposes of government, the preservation of law and order, the advancement of education and roads, but, as a natural corollary with that responsibility, into full ownership and sovereignty. "If this be treason, make the most of it."

Mineral Leasing Law

It was never the intention of the founders of the Government, of those great statesmen in the days of Webster, Clay, Calhoun and Benton, that the Federal Government should ever engage in, or impose a system of rents, fees and royalties. Let me quote a sentence or two. Webster said:

> "The gentleman spoke of the centuries that must elapse before all the lands could be sold and the great hardships that the states must suffer while the United States reserved to itself, within their limits, such large portions of soil not liable to taxation. . . . If these lands were leasehold property, if they were held by the United States on rent, there would be much in the idea. But they are wild lands held only until they can be sold; reserved no longer than till somebody will take them up at low price. Sir, if in any case any state can show that the policy of the United States retards her settlement or prevents her from cultivating the lands within her limits, she shall have my vote to alter that policy."

While our Supreme Court has reaffirmed the right and custom of government to retain all mineral rights in its disposition of the public lands, yet it was with the intention and purpose of allowing and aiding our citizens to discover and locate the mineral resources, and in 1863 there was enacted the General Mining Law, which with certain amendments, is in force today. It is from the operation of this General law, that the particular minerals named were withdrawn and excepted by the General Leasing Act of February 25, 1920. Under the General Mining Law the prospector and miner was encouraged to locate, patent and own and enjoy private ownership which was best for him and for the state, without a royalty, without a profit to the Government.

> ***"There is a well-defined movement which is crystallized into bills now pending before Congress to place the remaining 184,000,000 acres of public lands on a lease or rental or grazing fee system, abolishing the free range and repealing or making inapplicable the 640-acre stock-raising homestead law. We are, therefore, face to face with the question of whether not only the areas heretofore reserved, but a total of 400,000,000 acres of the area of the present 11 public-land states is never to be settled, never to pass into private ownership or made taxable, but is to remain under the Federal Government as a perpetual landlord."***

The Government is in the peculiar attitude of making a profit out of its trusteeship. This is inconceivable and unconscionable in any other trustees. A trustee is paid for service. With the Government that means cost of administration.

The object of the General Mining Law was to *promote* the industry of mining. Under it mining was encouraged and no tribute in the form of royalty was demanded. The Leasing Act was opposed by the West until we were overwhelmed by Eastern numerical strength in the Congress. Forced to do so, we made the best Leasing Bill that we could get. If it is right to lease and exact royalties on the particular minerals named in that act, why is it not logical to broaden its terms and take in all minerals? Is that the ultimate object of the supporters of a leasing system? This tendency and purpose is evident in Congress, for at the last session potash, asphalt, gilsonite, elaterite and other like substances were brought under its terms. If it is not right as to all minerals, then in my judgment there is no excuse for maintaining it as to the minerals now embraced therein. Let us see how it works by taking a particular example: The areas in the great Salt Creek Oil Field on the east and south borders, to which no equitable claims had attached, or which had been abandoned, were sold at public auction in tracts of 160 acres. The oil industry paid for those leases $1,600,000 in cash. Those who have no regard for the industry and for the states in which the minerals are and the industries operate will say, "Wasn't that fine for the treasury of the United States? That belongs to all of us." Short-sighted selfishness. But how has it worked out? Those leases exacted flat royalties of from 25 percent to 33 1/3 percent. It was not long before it became evident and soon became the fact that the owners or operators could not continue to operate the leases on these tracts at a profit. Applications are even now being made and allowed, reducing these always excessive royalties perhaps to 12½ percent. I venture to guess at this figure because that is about the average royalty of the reduced production under the graduated scale of royalties in the General Leasing Act as to the rest and the main body of the Salt Creek field. While production was flush, the Government has taken to date one-fourth and more of the production of that field. Ultimately this same experience will be undergone by the operating companies, even though new sands with new flush production are found at greater depth. The time will come with all when 33 1/3 percent, 25 percent or 12½ percent can not be paid. Then manifestly, all royalties will have to be taken off or operations will cease. Operators can not and will not operate at a loss. The result will be, if royalties are not taken off, that production will cease, with more than half of the oil still in the ground.

What principle supports the plan under which the Government has absorbed a one-fourth of the total production, or 12½ percent as the case may be, of the nearly 200 million barrels of oil taken from the Salt Creek field up to this time? If it means the cessation of drilling and production, if the industry must cease and untold wealth allowed to remain in the oil sands, we have arrived at a condition which demonstrates that the royalty system is economically unsound and

absurd, and of great detriment to the states in which the mineral resources lie.

A great Government should function toward better and greater ends. Legislation is not right in the long run which must be eventually repealed to prevent the cessation of operation and the death of the industry. It seems to me to be thus logically established that in every mine and every oil field affected by the Government leasing system, Government royalty must be eliminated. When we reach the point when operations are not profitable, as has occurred in some instances and will occur in all in time, then instead of promoting the mining industry, it has discouraged and destroyed it. It has been a burden from the beginning. Mining capital must have an incentive to compensate for the hazards; it must receive its return as in all other industries. If such is the effect of the leasing bill in the end, was it ever justified in the beginning or since? What is the net result? The Government has simply exacted, as long as the traffic would stand it, one-fourth of the total production. The wells drilled, the mines sunk, are lost capital with but little salvage. The early profits should be high to offset the later reduced profits and the final loss of the capital invested. The great element of risk and speculation in the mining business, particularly in oil, should be remembered. The Government in its activities should be helpful. Its only purpose should be to "promote," as it alleges its purpose to be in the title of the leasing bill. The leasing bill has laid extra burdens upon the industry. The states have shared to some extent in the oil—37½ percent. If it is right to exact royalties, then the states where the mineral is produced should have all. Let it be kept in mind that the 52½ percent now going into the reclamation funds does not go back to the state in cash or to their citizens. It goes into the construction of reclamation works, of which the great bulk of costs are the dams and reservoirs, the title to which, under the reclamation act, remains in the Government.

Nevertheless, the cost must be paid back by the settlers on the project and eventually the fund will go back into the United States Treasury. No one will contend that the states have not received some benefit by reason of the 37½ percent cash return and some benefits of the loan of the money to its settlers without interest through the reclamation service. But, in the long run, a state would receive more benefit by its administering the leasing system, if we must have one, taking all of the royalty. The state in fixing a royalty would at least set it at such a figure or reduce it, or eliminate it, as will enable the industry to develop and thrive, and will encourage new discoveries and development. This whole matter is one distinctly for the states themselves to handle.

"When it comes to the Rocky Mountain states, we find that under a new policy to which all the rest of the states were never subjected, the Federal Government through Congress has permanently withdrawn from the process of settlement and placed beyond the power or possibility of ever coming into private ownership and helping to sustain a sovereign state 200,000,000 acres."

The Unreserved and Unappropriated Public Domain

I am opposed to Government regulation of the remaining unreserved public domain, under 10 or 20 year renewal permits, all under a fee system.

It will prevent entry and settlement of the remaining great areas in 11 public land states.

It will tend to permanent Government landlordism.

It will put the Government deeper in business in the states when it should be getting out of the public land and other business which can be conducted by the states.

It reverses the steady policy of this Government, which under the Constitution is so "to dispose of" these lands to make homes, create private property and build up the states, which must maintain organized government and order over these domains.

The immemorial right of free range should continue, leaving the land open to settlement.

Fees should be decreased rather than raised.

They should be abolished rather than to create more burdens upon our industries.

"The leasing act was opposed by the West until they were overwhelmed by Eastern numerical strength in Congress. If it is right to lease and exact royalties on the particular minerals named in that act, why is it not logical to broaden its terms and take in all minerals. Is that the ultimate purpose of the supporters of a leasing system? This tendency and purpose is evident in Congress, for at the last session potash, asphalt, gilsonite and other like substances were brought under its terms."

The cattle business is bankrupt now and can not pay additional fees for grazing.

The cattle men and sheep men together use the free range now, in entire harmony, and the free range is not being overstocked and injured.

The small livestock growers should be encouraged and protected by liberalizing the 640 stock homestead act, in reducing the cash expenditures, increasing the area to two sections.

Unless the homestead law is so amended, then the Federal Government should either sell the balance of public domain, the best having been taken, for from 50 cents to $1.00 per acre, for surface titles, or it should cede the remaining lands back to the states from which it received them.

In any event, the Federal Government should now get out of the land business.

Preparatory to that, it should cease levying tribute to which the original states and the central states were never subjected.

It was never contemplated under our system of government that the nation should continue to exercise ownership and dominion over all these lands.

It was the purpose, and should be, to encourage the settlement of the lands, for the building and the development of the states. It is an anomaly and an unnatural condition that the Federal Government should retain indefinitely control of more than one-half of the area of these western states.

The proposed bill to regulate and charge for grazing on the public domain is wrong in principle and contrary to the best interests of the West and of the nation.

Water

Notwithstanding the recognition by the courts of the principle of water ownership and control by arid land states of the rivers of such states as distinguished from the riparian doctrine; notwithstanding such right of these states was stated and accepted by the Congress in the constitutions of these states; in spite of the recognition of state rights in this vital matter in the reclamation law of 1902, it is undoubtedly the purpose of the Department of Justice and of the legal advisors of the Interior Department and the Reclamation Service to assert and enforce, if they can, the doctrine of Federal ownership and control of the waters of our streams. The battle lines have been formed, briefs have been prepared, no doubt petitions have been drawn and are ready to be filed, to take from our Western states all power and authority over their (*Continued on page* 762)

LEASING OF THE PUBLIC DOMAIN*

Congress Spent Twenty Years In Arriving At A Plan To Dispose Of Public Lands Containing Minerals—Minerals On School Lands Has Developed A Condition That Requires Remedial Legislation — What The Government Has Given The People From The Handling Of Public Lands Outlined

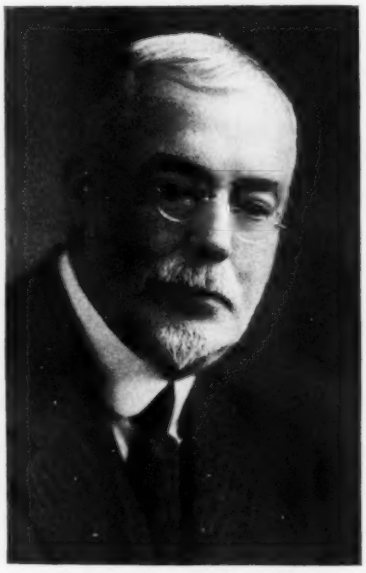
By HON. WILLIAM SPRY †

THE Constitution reposes in the Congress exclusive authority to dispose of the public lands and adopt rules and regulations in connection therewith.

The treaty under which our independence was acknowledged, while conceding to us all the claims of Great Britain to the territory of the colonies, did not carry title to the lands, which was then either in private individuals or in the colonies by virtue of prior royal grants. The new Government was therefore not a landed proprietor. However, notwithstanding the fact that the title to the surplus land was in the several colonies or states, the Continental Congress authorized the issuance of military bounty land warrants to both officers and men, and in 1780 appealed to the several colonies for cession of their lands. The appeal met with a loyal and generous response and an empire was contributed.

The policy of applying public lands or funds for internal improvements was not established without a struggle. It was contended by its opponents that the deepening of ports of entry, the improvement of water courses, the digging of canals, the construction of railroads, the opening of highways, the drainage of swamps, the reclamation of desert wastes, the founding of colleges, the maintenance of public schools, the laying out of new farms, and the establishment of homes were matters of individual or local concern, and that the Government should not contribute thereto in either public lands or money. It was maintained in support of the policy that increased production from the new farms and from the reclamation of swamps and deserts, while directly benefiting the individual and the immediate localities, added to the wealth of the country and that the nation prospered as its several units grew and expanded. So the policy was established and extensive grants made for colleges, schools, canals, railroads, and highways.

The Government has retained the ownership of its public lands for the reason, first, that in the early days they were essential to the nation as a basis of credit; second, the conditions of the cessions of the lands east of the Mississippi, from the original states, were that they should form a common fund for the mutual benefit of all the states composing the union; their donation therefore, to the state, within which situated, would violate the cessions under which they were acquired and the acts of Congress accepting them; third, it was believed that the Congress, with its wider vision, was the better able to distribute such lands than the legislatures of the several states. The wisdom of the policy is fully demonstrated. It is a matter of universal gratification that the disposition of the public domain has never been affected by partisan politics. The only rivalry between the major parties has been which could devise for the common good the better plan for disposing of such areas. The public lands constituted such a large part of the nation's wealth that the Congress has always guarded them with vigilance and the major policies for their disposition have been formed only after mature consideration. The committees dealing with the public lands, in both House and Senate, have always been composed of men of the highest ability, selected from all parts of the country.



Commissioner William Spry

So well has the Congress discharged its trust that today, after more than one hundred years, there remain 200,000,000 acres unentered and unreserved, and subject to all applicable public land laws. In addition there are approximately 135,000,000 acres of Government-owned lands within national forests, and 15 or 20 million acres have been patented with a reservation of the minerals to the United States. The areas so mentioned are exclusive of those in Alaska. We have now in the nation proper upward of 350,000,000 acres subject to exploration under the mining laws and to sale or lease thereunder if found to be mineral in character. Moreover, from the public lands we have our enormous timber supply, the national forests, our splendid playgrounds, the national parks, our refuge for buffalo and elk, our bird preserves, our water power withdrawals, military and naval reservations, together with large areas of arid lands now undergoing reclamation through Federal agencies.

On the other hand, the states have not, as a rule, conserved their quantity or school grants except in those instances where the Congress placed a rigid condition on their disposal; the millions of acres of swamp lands given to them were frittered away with little or no attempt to secure their drainage, and their administration of the Carey Act leaves much to be desired.

MINERAL LANDS

Since the discovery of gold in digging the race at Sutter's mill the mineral deposits in the public lands have been the object of the nation's solicitude. How best to secure their development has received the mature consideration of our most eminent statesmen with the result that all minerals have been set apart from disposition except under the mining law, and our deposits of gold, silver, copper and other metallic minerals have been dedicated to the miner. It took Congress almost 20 years to evolve a plan for the disposition of such lands, but when it arrived at a conclusion the language of the law was so simple, its provisions so comprehensive, and its requirements so reasonable that the act has stood the test of experience without any material change affecting the metalliferous group. The law combined the wisdom of the mature lawyer and the experience of the prospector with his grub stake. Its prime purpose is the discovery of the mine and its development.

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†Commissioner of General Land Office, Department of Interior.

Science has wrought wonders in the development of the mine and the extraction of the minerals. It has led to new methods under which low grade ores are made profitable and through which the refuse of former years is utilized. Its engineers promise a plan under which placer gold mining in California may be renewed, but the scientist never found a gold mine. It is the prospector who climbs the mountains, descends into the gulches, toils over blistering sands, and lives with the rocks, who discovers the gold. Wisely the law has placed no limitations upon his tireless activities. For 50 years no change has been made in the simple chart by which he is guided, and to him goes the full reward of the finder. The nation's gain is the wealth produced by its mines. Our fuel minerals, coal, oil and gas, on the other hand, respond more readily to the call of the geologist and the Government experts have been of incalculable service in tracing their location. They are not open to sale in unlimited quantities. They are set apart for prospecting and lease under provisions preventing their monopoly but designed to encourage their production. From them the Government receives the royalty of the owner. The almost universal use of oil products in transportation, the disturbance of business, and the hardships suffered by our householders by reason of the recent coal strikes admonish the Government that it must husband its great store of mineral fuels and if necessary control their output.

The School Sections

Notwithstanding the fact that the older states, in their deeds of cession, made no reservation for the endowment of their public institutions, colleges and universities and the support of their common schools, when Ohio, the first state carved from the "public fund" contributed by such states, was admitted into the union in the year 1802, she was granted sections numbered 16 in every township and indemnity therefor where such areas had been otherwise disposed of, for the use of schools, but the state was required to provide by an ordinance irrevocable that it would not tax any of the public lands of the United States until after the expiration of five years from their sale.

When Louisiana, the first state organized from the French cession under Napoleon, was admitted by the acts of 1811 and 1812, she was required to enter into a compact disclaiming all right of title to the waste or unappropriated lands within her borders and that she would not tax such lands. Substantially similar conditions have been imposed on every public land state irrespective of whether the territory within its boundaries was acquired by gift, purchase, or conquest. The Supreme Court, however, has held that such compacts are unnecessary; that the provision in the Constitution lodging in the Congress the sole power to dispose of the public lands precludes any state from taxing such lands or in any manner interfering with their disposition.

In addition to the quantity grants for the endowment of colleges, universities and charitable institutions, the first 12 states to be admitted into the union were granted one section in every township for the support of common schools and where such section had been disposed of, indemnity of a like area. Fourteen Western states, including Nevada, were granted two sections to the township, but Nevada surrendered her numbered sections and accepted a quantity area in lieu thereof. Three states have been given four sections to every township.

No mineral exclusions were made in the grants to Ohio and the other 11 states receiving but one section each for the support of common schools. There were, at the date of the admission of such states, no operating mines and no known minerals within their borders. But when the states receiving two or more sections applied for admission the existence of minerals was well known and the grants to the states of the school sections followed the established policy of Congress of retaining the mineral deposits for the purpose of disposing of them under the uniform provisions of the mining law. They were withheld from the railroads and from the settlers. Their exclusion from the state grants was no exception. Whether the fact of the reservation of the minerals had any influence in increasing the grants from one to two or more sections to the township can not be stated.

Not only have the grants to the states for the support of common schools been generous, but in the adjudication of the titles to such sections where the question of the mineral character of the land is involved, a rule more liberal to the states than to either the settlers or the railroads has been adopted. The language of the acts making the mineral exclusions is almost identical and yet in construing the rights of the state, the Department and the courts have applied the governing date; the admission of the state into the union if the sections were then surveyed; if surveyed thereafter the date of the identification of the land by the approval of the survey plat by the Commissioner of the General Land Office. If not then known to be mineral the title passes to the state. The settler loses the land if at any time prior to his submission of satisfactory proof the lands are discovered to be mineral, while in the case of the railroad the Government may inquire into the mineral character of the land at any time prior to the issuance of patent. Preferences to the states are extended for the satisfaction of their grants upon the filing of the public survey plats and nine of the states may, upon the application of their governors, secure a withdrawal of the lands which operates as a reservation for the exclusive benefit of the state from the date of withdrawal for a period of 60 days following the filing of the plats. Moreover, such states, upon their election, may advance the money for the execution of the surveys and it becomes the duty of the commissioner to proceed immediately with such work. Finally the Government repays to the state every dollar so advanced.

Little difficulty was experienced in the adjustment of the school section in the South and Middle States, but in the West, with its highly mineralized areas and the exclusion of mineral lands from its school sections, a condition has arisen that requires remedial legislation. Title by operation of law worked well in the nonmineral states, but in the West it leaves the situation too uncertain. Title may or may not pass.

The Department, since 1914, has repeatedly recommended legislation that will authorize the issuance of patent to the state grant lands, to the end that the state may have the same evidence of title that is given to others. The patent ends any controversy in the Department. It is a formal declaration by the Government that the patentee has earned the title.

The Government is not seeking to deprive the states of any rights they now have under the law and earnestly desires a settlement of the controversy in a manner just to both state and nation. Relief may be extended in deserving cases and justice to all effected by a simple measure that will first authorize patents in all cases where the school sections were not of known mineral character at the time the grant would have otherwise attached; second, a preferred right of purchase of the surface with a reservation of the minerals to the Government where the lands were secured from the state in good faith and were subsequently ascertained to be of known mineral character at the effective date of the grant, with a further preference to such purchaser to lease the lands subject to the mineral leasing act; third, a period of six years where the lands are now surveyed and six years after the approval of the survey where now unsurveyed, within which the Government must institute proceedings looking to the determination of the mineral character of the lands at the effective date of the grant. The adoption of such an act would enable the states to secure an

immediate adjudication of their claims or they could await the period within which the Government may take affirmative action. At the end of such period without such action the title of the state would be unassailable.

I now address myself directly to the people and the officials of the mineral public land states.

The Government has always dealt fairly with the homeseekers and with the public land states. In the early days its military posts went along with the settlers and its cavalry always responded to their call, and it gave them the lands of their choice.

It erects its own public buildings and buys every foot occupied by it in your cities and larger towns, and pays a liberal rental elsewhere. At a loss to itself it delivers your mail at your doors. Its public land subsidies have brought the railways to you. It has presented you with more than 200,000,000 acres of land to drain your swamps, endow your state institutions and support your public schools. It has expended upwards of $200,000,000 in connection with the reclamation of your arid wastes and since 1916, has, with advances heretofore made, authorized the expenditure of $840,000,000 to aid in the construction of public roads. It credits you with 5 percent of the net proceeds from all public lands, returns to you in the reclamation of your desert lands 52½ percent and allows you 37½ percent of the royalty secured under the mineral leasing act; one state, since the year 1920, has received from its 37½ percent of the royalty on oil alone more than $14,000,000, and now you demand the mineral school sections.

There is little choice in your principal measures. One bill reverses the policy of more than 75 years, and donates the minerals to the state. It has at least the merit of frankness. The other requires hearings before the local registers, appeals to the commissioner and from him to the secretary, and then, after a delay of two years, permits the state to reopen the question by filing petitions in the Federal District courts whereupon there is a new adjudication on both questions of law and of fact with further appeals all the way to the Supreme Court of the United States, and it hamstrings the Government by excluding from consideration competent evidence. It will necessitate interminable delays, excessive costs and a harvest of lawyer fees. By circuity of action it is designed to accomplish the same result. The Congress has established a special tribunal, now the Secretary of the Interior, to determine all matters of fact, and in the first instance all questions of law affecting the public domain. The Secretary is assisted in this duty by the Assistant Secretaries, the Solicitor, the Commissioner of the General Land Office, the local registers and a corps of legal and scientific experts. He is well equipped to perform the duty imposed on him by law. Then why relegate matters of facts to the courts?

It is our mineral fuels, coal, oil and gas, pointed out to you by our geologists that you covet. Their retention by the Government in our common good is demanded and yet to secure them you strike at the very roots of our mining industry and imperil irrigation. If you wreck mining there is an end to reclamation.

Metalliferous mining at its best is a hazardous enterprise. The lot of the prospector is hard. No hireling's part is his. No person will, for pay, endure the hardships the prospector undergoes for the very love of the quest. He spends his life in the wilds and all the comforts are denied him, and too frequently, when all is over, he fills the grave of the pauper. Nor has the operator of the mine an easy task. With all the aids of science and modern improvements the extraction of the ore is expensive and capital is wary. The dishonest promoter has made it difficult to finance the meritorious project. You can name at will the great successes, but what volume is large enough to record the failures. You have profited by the development of the mines. Your early fortunes were based on their products and the peopling of your territory hastened at least by decades by their development. Then why add to the burden of both prospector and operator by a division of ownership? Why confuse them with section lines and why hamper them with a multiplicity of law? Reclamation is supported by the proceeds from the public lands and during the last fiscal year more than four-fifths of the receipts were from the mines. Measured in money the mineral sections are not important to the Government. Under its uniform policy of disposing of metalliferous minerals in such manner as to induce their discovery and production, the Government has secured but little in cash in connection with them, and 90 percent of the proceeds from the nonmetalliferous group under the general leasing act go to you either directly or indirectly. But since the credit of the country was firmly established and the public lands were no longer needed for purposes of revenue, the dollar mark has been removed from them. They have been appraised in terms of economic and beneficent use.

It is therefore the wise policy of Congress providing for their disposition for the common good that you would frustrate. You have everything now of value from them except their control and possible exploitation.

Statehood with its benefits and responsibilities was not forced upon you; it was granted at your request. You knew when you applied for membership in the sisterhood and since the admission of Ohio, the first public land state, each new state entered into a solemn compact with the Government that it would not tax the public lands and in no way interfere with their disposition. You were aware that since the discovery of gold in California, minerals and mineral lands have been set apart for disposition under the mining laws and withheld from the settler, from the states, and from all else save the miner. You accepted the grant of the numbered school sections with minerals excluded and the right to take indemnity for such mineral losses. There has not been the slightest misunderstanding on the part of the states or the government. All parties acted with a full knowledge of the facts and there is now no question about the law.

Your present demands that you be given the mineral school sections is a repudiation of your solemn acceptance of the grants and your insistence that the rules of evidence be changed and that the Department be excluded from the final consideration of the claims is equally indefensible.

I do not ask you to emulate the example of Virginia and donate an empire. In the first place you have no empire to give, and in the second place the Government is now strong and stands in no need of charity and therefore desires no sacrifices. But can't you meet us with the spirit of South Carolina who declared in her cession "that this state is willing to adopt every measure which can tend to promote the honor and dignity of the United States and strengthen their Federal union"? Why not pause and meditate upon that sentiment? The mineral lands do not belong to you and never did. The public lands were acquired by gift of the older states, by purchase, and by the blood of our sons. No public land state has added an acre to our flag. But if you give no heed to the common good of the nation, if you are not inclined to reflect, if you would violate the solemn compact under which you received the school sections, will you not as a final appeal, look to your own interests?

Mineral school sections are no exception to the general rule. The development of the mine benefits primarily the community in which it is located. It furnishes employment to the people, builds the towns, increases trade and adds to the tax roll, and the same is true of reclamation. The immediate locality rather than the country at large, profits as the result of irrigation. In both instances the nation's gain is but the reflex of your local prosperity.

SCHOOL LAND TITLES IN PUBLIC LAND STATES*

Absentee Landlord Business Not Proper Function Of Federal Government—State Sovereignty Is Nation's Strength — Congress Should Confirm Its Original Grants So That States May Have Possession Of Minerals And All Other Things On The Land—Urges Congressional Action

By HON. GEORGE H. DERN †

WHETHER we are mining men or public officials or whatever our occupation may be, our first thought is the greatness of the United States of America. There is no difference between us on that. We are Americans first, and Utahns or Coloradans or New Yorkers or Virginians second. I endorse the doctrine that state sovereignty is the nation's strength, as it was outlined by President Coolidge in his address delivered during the exercises celebrating the fiftieth anniversary of Colorado's admission to statehood held in Denver on August 3. I quote from his address as follows:

> "The nation is inclined to disregard altogether too much both the functions and the duties of the states. They are much more than subdivisions of the Federal Government. They are also endowed with sovereignty in their own right. Of course, one of their chief glories lies in the fact that they are all partakers of the American spirit; all a part of the American nation; but a great deal of the strength of the Federal Government lies in the fact that the states have the power to function locally and independently, subject only to the restrictions which they themselves invoked by adopting the National Constitution."

In his concluding paragraph he says:

> "The progress that it (Colorado) has made in these years has been in no small part due to the application of principle of local self-government. Of all the wealth and eminence that this state has achieved, this is its chief treasure. It ought to be maintained undiminished and guarded with jealous care through all the years to come."

Another easterner, Governor Ritchie, of Maryland, in his speeches has been insisting that strong states are vital factors in our national policy. He said at Boston in April:

> "Let us do all we can not only to preserve the rights of the states, but to preserve all their customs and traditions and political powers and to foster the pride and affection of posterity in them. It is through the states that we must assimilate and Americanize our immigrants, and it is here that our civic virtues and ideals can best be cultivated. The future of America rests on the states, not on the Union."

It is refreshing to us westerners to hear these wise words coming out of the East. We have waited long and patiently for them. Let us hope that they are not mere words, but that they will be backed up by actions that will give the public land states of the West a little more sovereignty and a little more of the local self-government which the President lauds as our chief treasure. I venture to say that the people of Colorado are ready and willing to govern a little more of their own state just as soon as the Federal Government will let them. I know the people of Utah would be glad if they could exercise sovereignty over the land within the boundaries of their state. I have no doubt that every one of the public land states will make a legal holiday of the date when the Federal Government goes out of the absentee landlord business, and gives the states a chance to grow and develop into the strong states which we agree are vital to the greatness of the nation.

George H. Dern

The President says the states are also endowed with sovereignty in their own right. But are we? The dictionary says sovereignty is the right to exercise supreme power. A sovereign state is defined as one which controls its own domain and administers its own government, without being dependent upon or subject to any other power. Is there not a good deal of fiction about referring to the public land states as sovereign states when they do not control their own domain? In Utah three-fourths of the area of the state belongs to the Federal Government. We do not own or control it, either as a state or as citizens. The State of Utah and the people of Utah own only one-fourth of the state, yet they have to police the whole state, build roads over the whole state, and incur other expenditures on account of the domain that they do not own. People of the eastern states, where 100 percent of the land is in private ownership and paying taxes, and therefore all under the control of the state government, can not conceive the exasperating burden of making one-fourth of the state support the other three-fourths in idleness.

The situation is similar in all the western states. In Arizona 67 percent of the area of the state is still in the control of the United States Government. In New Mexico it is 43 percent, in Idaho 67 percent, in Nevada 87 percent. I have not the complete statistics, but we are all in the same boat. We are not sovereign states, but are under the paternalistic control of Uncle Sam in a very important degree.

It is true that much of the public domain is subject to entry by private citizens. They may locate mining claims or metal deposits and get patents to their claims. They may also take up homesteads, but the trouble is that there is scarcely any land left that is worth homesteading. In a recent publication of the U. S. Department of the Interior, stress is laid upon the fact that the public domain of the United States is diminishing at a rapid rate, and that what is left is unfit for farming and of little agricultural use. The remaining lands offer no inducement to citizens to settle upon them, not being sufficiently productive to support a family. We, therefore, do not look upon Uncle Sam's domain with covetous eyes on account of its agricultural possibilities. Unless we get some mineral, most of our school lands are worthless.

Of course, we do not deny the Federal Government's title to the unappropriated and ungranted lands in our state. Article III of the Constitution of Utah contains this section:

> "Second. The people inhabiting this state do affirm and declare that they forever disclaim all right and title to the unappropriated public lands lying within the boundaries hereof, and to all lands lying within said limits owned or held by any Indian or Indian

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†Governor, State of Utah.

> tribes, and that until the title thereto shall have been extinguished by the United States, the same shall be and remain subject to the disposition of the United States, and said Indian lands shall remain under the absolute jurisdiction and control of the Congress of the United States. The lands belonging to citizens of the United States residing without this state shall never be taxed at a higher rate than the lands belonging to residents of this state; nor shall taxes be imposed by this state on lands or property herein belonging to or which may herafter be purchased by the United States or reserved for its use." * * *

I presume the constitution of every public land state contains a like clause, for this was one of the conditions of their admission to the union.

All that I have said so far is preliminary to the specific object of my attendance at this meeting, which is to discuss the restricted subject of school land titles, and frankly to solicit the aid of this influential organization in getting relief for all of the public land states. I shall discuss this subject from the standpoint of the State of Utah, not because there is anything about Utah's position that is peculiar or special, but because I can probably explain the predicament of all the public land states more clearly and concretely by using my own state as a typical example.

Utah was created out of the territory that was ceded to the United States by Mexico as a result of the Mexican War in 1848. The entire area of the state therefore became the property of the United States, and title to land had to be obtained from the United States, through purchase, homestead entry, mining locations, or otherwise.

The permanent settlement of Utah began in 1847, and its settlement and development went forward at a rapid rate, so that by the time she was admitted to statehood the desirable agricultural land had practically all been taken up. Settlements had been planted wherever there was water that could be used for irrigation, and all the land had been brought under cultivation that could be irrigated by the natural flow of the streams. The land that remained was largely range land, desert land, and land that could not be irrigated for want of water, some of which might be reclaimed by building costly water storage projects. Notwithstanding the fact that Utah's cultivated valleys are world famous for their beauty, fertility and productiveness, a large proportion of the state is a veritable desert and has no value except for its rugged and impressive scenery. Anyone who has ever crossed the Great Salt Lake Desert on the Western Pacific Railroad knows that this is an enormous tract without a spear of vegetation. Along the Colorado River there are stretches as far as the eye can reach with nothing but naked sandstone, no soil and no vegetation.

There are other parts of the state that are equally desolate, stony and forbidding, as well as vast areas that fall within the category described by the Interior Department as offering no inducement to citizens to settle upon them, not being sufficiently productive to support a family. The Register of the United States Land Office at Salt Lake City testified before a Senate committee a year ago that there are 12,000,000 acres, or nearly one-fourth of the state that nobody would want to take up under the present public land laws, because it is not worth paying taxes upon. Substantially, this has been Utah's condition since she became a state—the desirable land was already gone at that time.

It is important to keep in mind a picture of Utah's development. The total land area of the state, exclusive of the lakes, is 52,600,000 acres. The irrigated area is only 1,371,000, or 2.6 percent of the whole. This irrigated area is capable of some extension, by building reservoirs to store the flood waters, but according to the best estimates we can not expect to do more than double it. We also have about 500,000 acres devoted to dry farming, which is not being extended. We shall do well if we ever cultivate 6 percent of the area of our state. It is a point of great significance that so slender a portion of our state lends itself to agriculture. Compare it with the great agricultural state of Iowa, whose boast it is that every quarter section is a good farm, and you have some idea of the odds against which we are fighting in our state building.

In 1896 Utah was admitted to the union by virtue of an enabling act, entitled, "An act to enable the people of Utah to form a constitution and state government, and to be admitted to the union on an equal footing with the original states." It would be hard to make us believe that we were admitted on an equal footing with the original states, because they got all the lands within their borders and we did not. Neither are we on an equal footing with the Middle States, for there too Federal Government sold all its lands into private ownership as rapidly as possible, while in the western states it is proposing to hold the best lands permanently as national forests, national parks, national monuments and other withdrawals. Instead of being on an equal footing with our elder sisters, we are treated as stepchildren.

One of the provisions of the Utah enabling act is "That upon the admission of said state into the union, sections 2, 16, 32 and 36 in every township of said proposed state * * * are hereby granted to said state for the support of common schools.' I have quoted the exact language of the enabling act to show that there is nothing in its wording that reserves mineral lands from the grant. Language could not possibly be plainer. Without any qualifications whatever, Congress said four sections out of every township should be given to the state as school lands. There were also sundry other floating grants for the benefit of the State University, the Agricultural College, and other state institutions.

This grant might have been a fair endowment for our schools if we had got just what the enabling act gave us. It might have yielded substantial revenue for our schools without a crushing burden of taxation. Unfortunately, after the passage of the enabling act and the adoption of the constitution the Federal Government began, as it seems to us, to undo the work of Congress by claiming that lands known to be chiefly valuable for mineral were not included in the grants made to the state. The Government took the position that while the enabling act did not specifically reserve minerals, neither did it specifically grant minerals, and that, therefore, under the doctrine of an established public policy all mineral lands were reserved and did not pass to the state. That was the beginning of our school land problem, over which we have been sweating ever since. In his message to the Legislature in 1915, Governor Spry, who is now Commissioner of the General Land Office, used the following language.

> "No matter has given the state administration more serious concern during the past two years than the question of the state rights to the school sections in place granted to it by the Congress of the United States under the terms of the enabling act. A marked tendency on the part of the National Government to deprive the state of all school sections that have a value other than agricultural and grazing, coupled with the national policy of land withdrawal for forest reserves, national parks, national monuments, etc., has grown to those who are charged with the safeguarding of your interests little short of alarming. State officials, recognizing the ultimate hardships which the policies will ultimately work upon the people, have been active in protesting against their continuance; and the power site leasing bill now pending in Congress has been vigorously opposed as tending to deprive the state of a valuable source of revenue in taxation that rightfully belongs to it, and stifle development, just as the proposed mineral leasing system would curtail our revenues and cause stagnation in our mining industry.
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> "Your attorney general has been actively engaged in laying a foundation for legal protection of the state's undoubted right under the terms of the enabling act to school sections containing hydrocarbon deposits. While I recognize the inability of the legislative assembly to adopt any measures

to relieve this situation, still I am constrained to call the matter to your attention as involving the most serious problem that confronts the state, since it strikes at the very foundation of our revenue system, threatens retardation of development and jeopardizes beyond calculation the school fund of the state, which is to be derived from the disposal of our school sections. Your investigation of this subject, I am sure, will lead you to memorialize Congress on the matter, praying for a continuation of the liberal land policies that have prevailed in the past and bespeaking in the operation of the national policy a strict compliance with the terms of our enabling act."

The attempts to secure relief through litigation have been unavailing. The problem is still the most serious one that confronts our state and the rest of the public land states. The only avenue of relief is congressional action, and that is what we are seeking now. In view of his former intense interest in this matter on behalf of his native state, we hope for the active cooperation of Commissioner Spry as well as of his chief, Secretary of the Interior Work, who is likewise a western man. We have felt that with officials in charge of the Interior Department who are familiar and sympathetic with the problems and needs of the West, this ought to be a favorable time to bring our hopes to fruition.

What we want is that Congress shall confirm its original grants so that we may have what was originally given us, mineral and all. In asking this we are not asking for special favors that the other states have not received. As a matter of fact, other states, including Michigan and Minnesota, which were admitted under enabling acts containing almost the identical language of the Utah act, received and kept their minerals. Michigan got the great copper and iron mines found in her school sections, and I am told that the great University of Michigan, at Ann Arbor, as well as the mining school at Houghton, have been built and supported largely by mineral royalties.

Minnesota got the iron mines that were found in her school sections, and the revenue from mineral, timber and agricultural lands has now created a trust fund of $57,000,000 for the support of the schools, university and other institutions. The state auditor writes me: "It is estimated that within 20 years our trust funds will amount to over $150,000.000, which will mean a great benefit to the schools of this state. We might have had a chance to build up a similar trust fund in Utah if the terms of the enabling act had been literally followed, and our people might not have been burdened with such a heavy tax on property.

Oklahoma collected in 1925 in bonuses, rentals and royalties from her mineral lands which belong to the state $991,000, and has built up a fund of nearly $9,000,000 from this source. It is well known that Wyoming is on Easy Street on account of oil royalties from a school section that she somehow managed to hold, although the title to the rest of her mineral bearing school sections is now in jeopardy, and she is just as much interested in this problem as are the rest of the public land states. Texas retained the ownership of all her lands, mineral and all, when she came into the union. I have already explained that the Federal Government never owned any land in any of the original states. At least 26 states including the original thirteen and their four children, and also Michigan, Wisconsin, Minnesota, Kansas, Alabama, Oklahoma, Florida and Texas received all their minerals. Why, then, should we be accused of trying to seal the Holy Grail when we ask simply for the minerals contained in the school sections that Congress granted us without any reservations?

With the mineral resources that exist in Utah in the form of iron, coal, hydrocarbons, oil shale, petroleum, potash, salt and a hundred other minerals, we might have reaped handsome benefits if we had been permitted to develop as other states developed and had been allowed to keep our mineral school sections. If any state ever needed its minreal lands, Utah did. If our schools, our university, our agricultural college and the rest of our state institutions were to have any endowment that was substantially worth while, they needed the minerals that Congress apparently intended they should have.

The grievance of the hour is high taxes, and I am sure Utah is not unique in this respect. When we analyze our taxes we find that the school taxes amount to more than all the rest of the taxes put together. Fifty-three percent of all the taxes collected in the State of Utah is spent for educational purposes. We do no want to cripple our schools by spending less money on them, for we believe that under our democratic form of government there is nothing that is more important than education. Where the people rule they must be enlightened to rule wisely. If the Government is to be strong and wise and just, as a good government must be, the citizens who comprise that government must be intelligent, enlightened and capable of understanding, defending and perpetuating our American institutions. We believe in the great American system of free public schools. They are training schools for democracy and citizenship. In them we educate our rulers, for the people are our rulers. None of us want to be ruled by a body of people who are ignorant of human rights and liberties; we fear the tyranny of ignorance.

Education is an insurance against the impairment of our liberty. Wherever you find intolerance, bigotry, fanaticism —mankind's greatest enemies—you will find ignorance and superstition. People harbor these vices because they do not know any better. It is the ignorant man who has such a ridiculously sublime faith in the infallibility of his own beliefs that he wants to impose them upon everybody else. Tolerance and liberty flow from education and enlightenment.

Imbued with this conception of education, many leaders of thought in the nation have come to the conclusion that the National Government has a very vital interest in the education of its citizens, and it has therefore been proposed that there should be a Department of Education whose head should sit in the President's Cabinet; and also that there should be Federal aid for education. Without arguing the proposition I merely mention it to show that there is a widespread conviction that popular education is a matter of national concern, and that the National Government ought to give it every reasonable encouragement.

Indeed it has been the historic policy of the National Government to encourage education by land grants for the support of schools in the various states. Away back, before the Constitution was adopted, it began to grant school lands, and it kept it up until the last territory was admitted to statehood. Why should it now set aside that time honored policy or weaken it by taking away from the schools in the public land states the mineral lands that Congress so freely and wisely gave? Why should it arbitrarily put a narrow construction upon an act of Congress for the support of the public schools, when the Supreme Court of the United States has said: "And it is of fulther significance that this court has recognized that the legislation of Congress designed to aid the common schools is to be construed liberally rather than restrictively?"

So far as Utah is concerned the Government's course can not be defended on the grounds that it is saving the natural resources of the state from falling into the hands of the spoiler. Utah has a mineral land leasing law under which all minerals in state lands are reserved to the state. When the state sells a piece of land it only sells the surface. If the land contains minerals they remain forever the property of the state and can never be sold, but can only be leased on a rental or royalty basis. Consequently the conservation argument does not apply to this question; we are just as good conservationists as the National Government. If it seeks to point at our past record, where we permitted valuable lands to go into private ownership at what now look like ridiculously low prices in order that the state might be de-

veloped, we reply: "Look at your own record; you did the same thing yourself." Millions of acres of land were given away as homesteads. Was the homestead policy a mistake and a failure?

I have often tried to figure out who is benefitted by reserving the minerals in school lands to the Federal Government. The citizen who acquires the land is no better off, unless the state charges him a higher royalty than the Federal Government, which sometimes happens, showing that local control is more efficient than distant control. The state, under the present system, gets three-eights of the mineral royalties collected by the Government. If the state owned the land it would get the whole royalty. The National Government only retains 10 percent of the royalties and it spends that much and more in administering the act. So it does not seem to get much benefit.

The rule adopted by the Federal Government, that lands known to be chiefly valuable for mineral at the time when the state's title would have attached, did not pass to the state, was bad enough, but to this has been added a new doctrine known as the rule of geological inference, which means, for instance, that if a vein of coal is exposed on the side of a mountain all lands into which this vein might conceivably extend are coal lands and are therefore reserved to the United States. This theory has been carried to such absurd lengths that in my state school sections situated 23 miles from an outcrop have been claimed as school lands, although the coal, if there at all, and if it maintained its regular dip, would be a mile below the surface. Of course, a coal vein so situated probably would not be workable for centuries to come, and so it looks rather fantastic to say that such land is chiefly valuable on account of its mineral contents.

It is interesting to note that the Government is on both sides of the fence on the rule of geological inference. It takes mineral away from the states on geological inference, but the locator of a mining claim can not get a patent on geological inference; he must make an actual inference and have mineral in place. If that is a good rule for the citizen why is it not a good rule for the Government?

This rule of geological inference is being invoked so strongly that the states are being deprived of every vestige of a possibilty of ever gettng any mineral lands. Furthermore, new minerals are being discovered which were unknown when Utah became a state, and the Federal Government is very active in its efforts to keep our schools from getting any benefits from these discoveries. One of the greatest potential resources of Colorado and Utah is in the oil shale deposits in the Uintah Basin. The United States Geological Survey has estimated that these deposits contain 50,000,000,000 barrels of oil, which at $2 per barrel would be worth $100,000,000,000. Now, oil shale is not recognized as a mineral in Utah when the state was admitted in 1896. In fact, it was not seriously considered as a potential source of petroleum in this country until of late years. And even today it is not commercially valuable because no process has been developed to extract the oil and make it pay at present prices. Actually, therefore, these shale lands are not valuable for mineral right now. They are only valuable in a speculative sense. And yet the Government is depriving us of all our school sections on which oil shale is exposed or can possibly be expected by geological inference.

A very recent discovery in Utah is potash. A well that was being put down in eastern Utah for oil encountered what looks as if it might be the richest deposit of potash in America. There was no outcrop, and no way to anticipate the discovery by geological inference, but if the Federal Government runs true to form it will devise some ingenius method to take this mineral away from the state. It seems to feel that it has a solemn mandate from Heaven or elsewhere to prevent the schools of the public land states from ever getting any mineral of any sort.

Just now we have an oil activity in Utah, and geologists think we are going to open up a rich oil field. A number of school sections are located on some of the best looking structures. If we can hold them our schools stand to reap substantial benefits, but I confidently expect that, although in 1896 nobody every dreamed of finding oil in Utah, the mere existence of a dome structure will be seized upon as evidence that this was known mineral land, and that the state can have none of it.

We are also the victims of a technical rule that a state's title to a school section does not attach until the land is surveyed. Of course our school sections can not be accurately identified until the land is surveyed and the corners established; but why should the date of survey fix the date when the land passes to the state? I repeat the language of the Utah enabling act: "That upon the admission of said state into the Union, sections numbered 2, 16, 32 and 36 of every township of said proposed state * * * are hereby granted to said state for the support of common schools." * * *

There is no reference here to the survey. It says: "Upon the admission of said state into the Union." How could anything be more explicit? Furthermore, it says, "are hereby granted." Hereby means here and now, not at some vague and uncertain date in the future. In other words, the state's title should attach as of the date of its admission into the Union. The survey should have nothing to do with the title; it should only show us our corners.

This point is of great importance because another rule is that if a school section was known to be chiefly valuable for mineral purposes *at the time when the state's title would have attached*, it did not pass to the state. It can easily happen and has often happened that land which was not known to be chiefly valuable for mineral purposes in 1896 may be valuable now, on account of new discoveries since that time. If the title passed to the state upon its admission into the Union, such land would be the property of the state without dispute; but if title passes only when the land is surveyed, the land may be taken away from us because the survey was made subsequent to the discovery.

The Federal Government therefore takes advantage of its own reprehensible dilatoriness in surveying the public domain to defeat the state's title to valuable lands. We have made every effort to have the Government expedite its surveying because we suffer such gross injustice from the legalistic rule that the state's title dates from the survey rather than from the grant.

If the public domain had all been surveyed in 1896 this question would not have arisen, but it is not all surveyed yet, and may not be for another 25 years at the present rate. A lot of new mineral discoveries may be made during that period, but the states would be denied any direct benefit therefrom under the rule that a school section is not ours until it is surveyed. We have already suffered great damage from this rule in the past. For example, school sections containing oil shale were certainly not known to be chiefly valuable for mineral in 1896, and but for this rule Utah and Colorado could have held their oil shale lands, which have now all been taken away from them.

It should always be borne in mind that the school land question does not involve the entire public domain. We are not asking for all the minerals in the states. We are only asking for the minerals in our school sections. In Utah this means four sections in each township. Uncle Sam still has the other 32 sections to play with. Are we asking anything very unreasonable when we say one-ninth of the minerals should be allowed for the education of our children? Could Uncle Sam put the money to any better use?

The loss of the minerals to which we think our schools are entitled is only part of our trouble. As a result of the contests instituted by the Government we are constantly engaged in interminable litigation with the Government. That is, we call it litigation, but it is not conducted (*Continued on page* 763)

WHAT CAN BE DONE FOR SILVER*

Three Things Are Advocated: Prevention Of Threatened Action Of India—Fostering Of Resumption Of Subsidiary Coinage In Europe As Currencies Of Various Nations Are Stabilized —Propaganda For Increasing Use Of Silver In Arts

By F. H. BROWNELL†

DURING the year 1925 silver averaged over 69 cents per ounce; its low was nearly 67 cents and its high over 71 cents. Today it is selling for 61 and a fraction cents per ounce. If the average price for the year 1926 is, say, 61 cents, and production remains constant, the silver industry will receive about 20 million dollars less for its product than it received in the year 1925. The sudden and rapid fall in price is generally believed to be due in large measure, if not entirely to the recent report of the Royal Commission on Indian Currency and Finance which, while obviously desiring to deal conservatively with the subject, has raised a most disturbing question as to the future trend of silver. The blow came just when the cause of silver seemed to be sailing happily over sunny seas and before favoring winds.

TREND OF SILVER SINCE THE WAR

At the end of the war, while the price of silver had risen to twice what it was at the beginning, yet none the less the long distance outlook seemed somewhat gloomy. England and many other countries had debased the fineness of their subsidiary coinage; silver had entirely disappeared from circulation in France, Germany, Russia, Italy, Austria and the many smaller nations of Europe engaged in the war and these countries were no longer purchasers, but sellers. Most ominous of all was the fact that when a consideration of the restoration of the currencies of these countries arose, many economists and statesmen thought that no place need be made for a subsidiary silver coinage. They argued that it was unnecessary and costly to buy and use silver when cheaper substitutes of copper, aluminum, etc., might be made to serve the purpose. For a time it looked as if silver might permanently disappear from the coinage systems of Continental Europe. Had it done so, an important market for silver would have been lost. The fear of this result was reflected in the price of silver which fell from its high of nearly $1.33 in January, 1920, to a low of 56 cents in March of 1921.

But the common people of European countries demanded silver. The bitter experience of the war had destroyed confidence in governmental money systems and had revived all the age long traditional belief in the precious metals themselves. When the money of some of the greatest nations such as Russia, Germany and Austria became depreciated to the point of utter worthlessness, the silver coin and the silver ornaments and utensils which those nations owned, still retained their former value.

F. H. Brownell

The demand for silver in the Orient made the highest price in 1919 that silver had known for 50 years and the bankrupt peoples of Europe sold their silver coins and silver articles to buy the necessary food to carry them through the desperate time immediately following the war.

Hence, when Austria, the first to rehabilitate its money system, omitted a subsidiary silver coinage, the great mass of its common people, the peasants and laboring classes, refused to be satisfied. They had no satisfactory medium for their small but important savings and refused to save the token subsidiary coinage offered. The habit of thrift was being destroyed and after a short experience, Austria began to introduce silver in response to the demand of her people. Germany had the same experience. Russia also began to buy silver to satisfy her people and by 1924 it became probable that Europe would resume her former custom of using silver for subsidiary coinage, and that when France, Italy, Belgium and the others finally stabilized their currencies, they too would restore their subsidiary silver currency. In addition, the campaign to increase the use of sterling silver seemed to be bringing satisfactory results and the silver world was looking forward to a satisfactory and thriving business. The outlook for silver became steadily, distinctly brighter and it seemed at the end of 1925 that we might reasonably expect silver to range more or less around 70 cents per ounce with a probably rising tendency.

Then came rumors of the report of the Royal Commission in regard to the currency of India, rumors which the publication of that report has to large extent confirmed. Silver began to fall and the whole outlook changed and is now regarded with anxiety. It is therefore particularly necessary that at this time we should make a careful study of the report of this commission and of its probable effect, if adopted, with a view of marshaling our forces to accomplish what may be done to soften the blow which may be dealt to silver.

HISTORY OF THE USE OF SILVER

First let us recall a few well known facts. The value of silver and gold, like that of the precious jewels, consists solely in the psychological attitude of mankind toward them. Their use for practical purposes as we use iron, copper or even platinum, is slight. The worth of silver and gold is based upon prehistoric custom starting when mankind first emerged from the age of barter and sale and felt the need of a medium of exchange. Because of their scarcity, beauty, malleability and easy formation into coins and objects of art, decoration and ornament, silver and gold were by common consent and immemorial custom, universally adopted and used as money. For long ages they passed more or less equally; then for a long period on a fixed parity; and then, as civilization evolved and the negotiations of trade and barter became more complicated, the difficulty of maintaining any fixed parity was so affected by the changing quantities of each metal, resulting from the

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† First Vice-President, American Smelting and Refining Co.

discovery of important mining fields from time to time, that gradually mankind, especially the western nations, abandoned the idea of maintaining a fixed parity between silver and gold and adopted the gold standard. The modern banking system evolved rapidly during the nineteenth and twentieth centuries through Europe and the United States. It is a marked advance over the custom previously existing since it mobilizes the wealth of a country and makes it available for the development of natural resources and industries. Without the modern banking system our vast and complicated practice of floating securities, investments, bonds and stocks of all kinds, would be impossible. But a banking system requires stability of standard and hence wherever a banking system has become well developed the desirability of a gold standard has become apparent and it has, as a rule, been adopted.

But here let us note with much emphasis, that the adoption of a gold standard does not and should not mean the elimination of silver as a subsidiary coinage and as a medium of saving small sums of money. Even though a gold standard is adopted there is still a function, and a most important function, for silver to perform. All important wars and revolutions serve to demonstrate the fact, that when the life of governments is assailed, when confidence in its ability to redeem its paper and token currency is impaired, the people revert at once to their hereditary confidence in gold and silver. There is not enough gold for the purpose and silver too, is necessary. The recent history of Europe in this respect, was also illustrated in the recent revolution in Mexico.

Development of a modern banking system which tends to lessen the amount of precious metal, both gold and silver, required by a country, depends upon stability of government, upon freedom from unwise taxation and upon a highly developed educational system. Hence the Orient—the Asiatic countries as a whole—never took to banking as we know it in the United States, England and other advanced countries. Their form of government was too uncertain; wars, bad systems of taxation, periodical lootings by marauding tribes or bandits, the lack of schools and educational facilities, all prevented the enormous populations of India and China from adopting the banking system as a popular institution. So these people continue to hold their savings in the form of actual amounts of gold or silver. In other words they "hoard" their wealth in that form. Now, the people of China and India form the densest populations in the world but are also the poorest and live nearest the bread line. The savings of the great majority of their individuals are not of sufficient amount to enable them to use gold and so because the oriental mind probably regards silver as equal to gold for ornamentation and more certainly because their poverty prevents the acquisition of gold, silver became the great medium of the poorer classes for hoarding purposes. Asia, to all intents and purposes, has remained and is still today the same greatest consumer of silver it has been throughout the world's history. China is openly and avowedly on a silver standard. India has theoretically been on a gold standard but for all practical purposes the amount of silver used by it has remained constant.

Present Monetary System of India

The currency of India is thus described by the Royal Commission (Volume 1, pages 5 and 6, paragraphs 10 and 11):

> "10. At the present time Indian currency consists of two kinds of token, paper notes and silver rupees, which are *mutually convertible*. The paper note is in form of a promise by the Government of India to pay to the bearer on demand a specified number of rupees. The rupee is a silver coin 180 grains in weight and eleven-twelfths fine. In addition to these two kinds of token, the sovereign is by statute legal tender for Rs. 10, and the Government is under an obligation to pay Rs. 10, when sovereigns are presented for encashment. As, however, the price of gold is considerably above this parity, the sovereign has disappeared from circulation and is not issued or tendered to Government."
>
> "11. The value of both forms of token currency in relation to sterling is at present being maintained between the gold points corresponding to a gold parity of 1s. 6d. No obligation has been assumed, but the Government as currency authority have freely purchased sterling when the rate has stood at 1s. 6 3/16d. * * * * *. The stability of the gold value of the rupee is thus based upon nothing more substantial than a policy of the Government, and at present that policy can be found defined in no notification or undertaking by the Government. It is to be implied from the acts of the Government in relation to the currency, and those acts are subject to no statutory regulation or control."

Reason for the Appointment of the Royal Commission

The Royal Commission was appointed to consider a proposal of the Finance Department of the Government of India for the adoption of a gold standard and gold currency. The chief objects of the plan were (Volume 1, page 14, paragraph 34):

> "(a) To eliminate the threat to the currency inherent in the possibility of a rise in the price of silver by dethroning the rupee from its position as a standard coin of unlimited legal tender, and thus also to enable the constitution of the reserves to be simplified by eliminating the silver therefrom; and,
>
> "(b) To cure the uneconomic habit of the people of holding the precious metals as a store of value, by assuring them, through the instrumentality of a gold currency, that the same measure which they mete out, in gold value, by way of investment or deposit with a bank, will be meted to them again, in gold value."

Perhaps it is well to enlarge a little on these two purposes. The first was the result of India's experience during the war. You will recall that silver rose from an average of about 55 cents an ounce in 1914 to an average of $1.11 in 1919 and a high of $1.33. The paper rupees redeemable in silver were freely presented. When silver rose to about 96 cents per ounce, the bullion value of the silver rupee exceeded its exchange value and it at once begun to disappear from circulation and to be melted down to be sold as bullion. Holders of paper rupees presented them for exchange for the silver rupee. Simultaneously the balance of trade was heavily in favor of India. England, to get the necessary silver to meet these two requirements, debased her own coinage from 900 to 500 fine and even then might not have saved the day had not the United States gone to her assistance and sold her 200 million ounces of silver under the Pittman act at $1 per ounce which was then less than the market price. With this supply of silver and the hearty cooperation of the United States Government in the matter of Oriental exchange, Eng'and was enabled to preserve the parity of the paper rupee and to save a great blow to the confidence of the Indian people in the stability and power of the English Government.

After the crisis was over, came the great reaction of 1920. The price of silver rapidly fell causing great disturbance. Apparently the idea prevailed, especially in India, that the present system is outgrown and dangerous, and a strong movement grew up among the Indian statesmen and savants, for a modification of the system. In response to this demand, a Royal Commission was appointed in August, 1925.

Review of the Case Presented to the Commission

The commission was composed of 10 members, eight of whom were residents of India and two residents of London. Of the residents of India, four were natives. All were able and distinguished men. Several months were spent holding hearings in India at which apparently, it was developed that sentiment of India was strongly for the establishment of a complete and independent gold standard system. After closing the

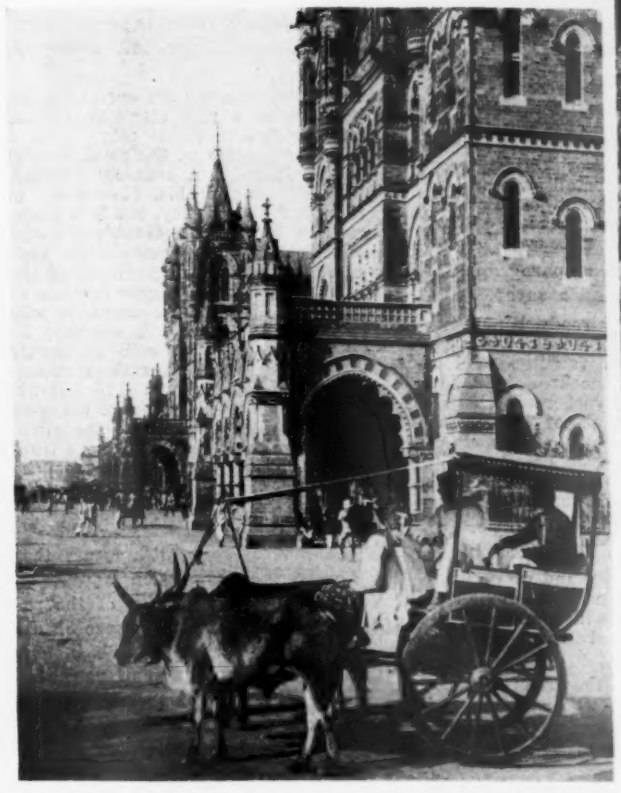
hearings in India, the commission moved to London where strong objections appeared against the plan.

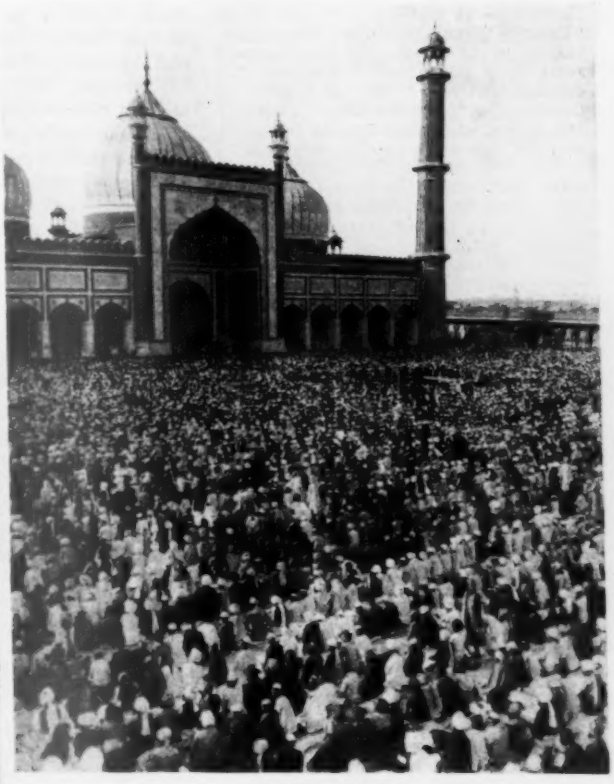
The circular of the National City Bank of New York City for September, 1926, beginning on page 171, reviews the arguments used, in a most admirable manner and I quote from it as follows:

"London did not view with favor a proposal which contemplated a requirement of 500 million dollars of gold for the Indian monetary system, in addition to the usual Indian absorption for ornaments and hoards. The bulk of the demand might be expected to fall on London, and in view of the state of British trade and industry, the obligation to pay 160 million dollars annually to the United States, and the fact that Great Britain herself has been back on the gold basis only about a year and needs time to fortify her position, this proposal seemed quite inopportune.

"Continental authorities view it in the same light. All of Europe has been suffering from scarcity of working capital and bank credit, with high interest rates, and the reserves of London could not be lowered without tightening conditions in every money market of Europe. Belgium, France, Italy and Poland are needing help for the support or reconstruction of their monetary systems, and industrial recovery in Europe is largely dependent upon their getting it.

"It seemed indeed an unfortunate time for India to be increasing her drafts on the gold supplies of the world, and particularly for the purpose of substituting gold for silver in common circulation. The general increase of industrial costs has affected mining costs in like manner, causing a falling off in the production of gold, while on the other hand the higher price level has made necessary a larger volume of credit in handling the turnover of trade and increased the requirements of all countries for gold reserves. What would be the effect upon the existing price-level of these proposed demands, and what the effect upon business of a possibly declining price-level?





Two characteristic scenes in India. The magnificent Victoria Railroad Station, Bombay, and, upper, some of the throng of worshippers at Ahmadabad. This is reputed to be the greatest and most beautiful mosque in India

Photographs by Underwood & Underwood

"India's Recent Absorption of Gold

"In order to appreciate the significance of the proposal it is necessary to know what a large share of the world's production of gold has been taken by India in recent years in the form of bullion, although taken solely for ornaments and private holding. In the five fiscal years ended March 31, 1914, the net imports of gold into India aggregated 472 million 415 thousand dollars, or an average of 94 million 400 thousand dollars per year. Since 1913 the movement has been irregular, owing to the war and the violent fluctuations of trade, but in the calendar year 1925 it exceeded all records, private imports of gold bullion into India rising to slightly above 200 million dollars, out of a total world's production of approximately 400 million dollars.

"The gravity of this movement is in the fact that gold taken by India does not remain a part of the world's monetary stock, as in the case of gold taken by any of the western nations. The gold stocks of Europe and the Americas may be shifted about from country to country and serve all countries continuously as a part of the world's capital employed in production and trade. These movements tend to maintain the industrial equilibrium and to stabilize prices in all countries in relation to each other. The gold which has gone from the United States to Germany in the last two years was added to the reserves of the Reichsbank and has not ceased to be a factor in prices in this country. On the other hand, the 200 million dollars imported by India in 1925 did not enter the banking reserves of that country, has not been devoted to investments or business purposes, and in all probability has been lost to the monetary stock of the world.

"Under the circumstances the financiers and economists of Europe could not look with favor upon a plan which seemed to favor an increased distribution of gold in India. It should be understood that in the aggregate, the cash banking reserve of Europe and the United States actually diminished in the year 1925, the net movement being away from the financial centers to what may be called the outlying countries and districts * * *

"Governor Strong of the Federal

Reserve Bank of New York, and other witnesses from the United States, explained to the commission that the gold reserves of the United States were all employed, if not to the limit of their capacity, as fully as they should be under normal conditions, and that this country was not eager to lose gold.

"They explained furthermore that while the sound condition of the Indian Government finances was well known in the United States, and under other circumstances an Indian loan could be easily placed, European needs would have to be regarded as more pressing in the immediate future; furthermore, that the feature of the plan dealing with silver would be very unwelcome in the United States.

"THE MENACE TO SILVER

"They pointed out that the United States, Canada and Mexico are the three countries leading in the production of silver, their aggregate in recent years being over 70 percent of the world's production, and that this country was largely interested in the production of the other two countries. The world's production is about 240 million ounces, of which India has been accustomed to take about one-third. The proposal seemed to contemplate that India would become a seller on a great scale, and they urged that such a development would spread consternation among silver producers everywhere.

"Even if sales by India were left out of the account, and the 687 million ounces to be sold by the Indian Government were simply held to be gradually absorbed by the home demand, it was difficult to see how the current world's production could be disposed of outside of India. China was the next largest purchaser, but the action of India would almost certainly affect the policies of China, and affect the demand for silver everywhere. It would seriously disturb the confidence of the world in the future value of silver.

"It was pointed out also that inasmuch as the bulk of the world's production of silver is now in connection with the production of gold, copper, lead and zinc, the production of all these metals would be affected, and the prosperity of the mining industry would be generally affected, and a very large sum of investments in the aggregate might be imperiled.

"It was urged that the people of India had been accustomed to esteem silver as one of the precious metals, and that notwithstanding the legislation closing the mints to free coinage, the continuance of coinage on government account and the maintenance of full legal tender powers had served, in large degree at least, to maintain the prestige of the metal. A further serious decline in the price of silver, however, reducing the value of the vast savings of the Indian people in this form, might have the effect of creating a greater demand for gold than has been known in India up to this time."

THE COMMISSION'S DECISION

The commission refused to adopt the full plan which was proposed from India but adopted a modified substitute. The chief difference, so far as silver is concerned, between the commission's plan and that proposed by the Indian Finance Officials, lies in a slower development, in taking more time for the acquisition of a gold reserve, the disposition of silver and in altering the legal character of the existing silver. The immediate effect on the silver market is obviously lessened by this course but the ultimate, long-run effect may not be.

The commission itself describes its plan toward the end of paragraph 54, page 21, Volume 1, as follows:

> "The essence of the proposal which we proceed to develop is that the ordinary medium of circulation in India should remain as at present the currency note and the silver rupee, and that the stability of the currency in terms of gold should be secured by making the currency directly convertible into gold for all purposes, but that gold should not circulate as money. It *must* not circulate at first, and it *need* not circulate ever."

And again, on page 84, paragraph 214, Volume 1, the commission says:

> "Reference has already been made to the importance of developing banking and investment facilities, and of finding means to encourage the people of India to divert their savings to profitable channels of investment. It does not fall within our terms of reference to suggest in detail all the measures which may be taken to this end. But, since the smooth working of a system of currency cannot but be impeded by the existence of large stores of currency in hoards, it is proper for us to urge, and we do urge emphatically, that nothing should be left undone which will tend to facilitate and encourage banking progress in India."

More specifically, the plan recommended by the commission may be briefly stated as follows:

1. The organization of a central bank in India to be known as the Reserve Bank of India which will be the sole source of issue of currency.

2. This bank is to have a gold reserve and is to buy and sell gold but not mint any gold. This the commission calls: "The Gold Bullion Standard" (page 24, paragraph 59, Volume 1).

3. The legal tender character of the English sovereign is to be abolished.

All of this seems wise and no objection can be raised to it. But the disturbing part of the commission's report is found in the following statements (Volume 1, page 87):

> "(xiii) The paper currency should cease to be convertible by law into silver coin. It should, however, be the duty of the Bank to maintain the free interchangeability of the different forms of legal tender currency, and of the Government to supply coin to the Bank on demand.
>
> "(xiv) One-rupee notes should be re-introduced and should be full legal tender.
>
> "(xix) The silver holding in the Reserve should be very substantially reduced during a transitional period of 10 years."

And again, on Page 25, Volume 1, the report says:

> "Under the system which we propose, that portion of the hoards * * * which is in the form of silver will presumably in course of time, be robbed of its latent power to disturb internal prices and money rates by being replaced—if the process of conversion should continue—by gold bars, or preferably by other more economic forms of saving."

Note especially the language of the report, Volume 1, page 32, paragraph 80:

> "Silver reserves are ordinarily out of place in a gold standard system. But in India, silver coin forms a large proportion of the total circulation. There is a seasonal ebb-and-flow of considerable dimensions in this form of currency, and it is necessary to hold a considerable quantity of rupees in the reserve to meet genuine demands for purposes of circulation. With the growing use of one-rupee notes these demands will, we hope, be reduced. In any case the present stock of rupees is unduly large. We, therefore, make a recommendation (paragraph 145 below), which will have the effect of ensuring the gradual reduction of the silver holding in the reserve, during a transitional period of ten years, from the present figure of Rs. 85 crores to Rs. 25 crores, on the basis of the present circulation."

From the foregoing it appears that the plan of the Commission is:

1. That the convertibility of the paper rupee into the silver rupee should be destroyed.

2. That the substitution of paper for silver rupees should be encouraged.

3. That the present holdings of silver in India should be converted either into gold bars or more economic forms of savings.

4. That not only ought the Indian Government purchase no more silver for coining into rupees, but that they should sell, over a period of ten years, a large part of their present stock.

AMOUNT OF SILVER INDIA MAY SELL

It is important here to estimate what this proposed sale of silver means. Mr. Handy, of Handy & Harman, has made a calculation which has been checked by Mr. F. Y. Robertson, vice-president of the United States Smelting, Refining & Mining Co., which I quote:

> "On page 6 of the report, the silver coin and bullion in reserves is shown as 84 7/10 crores of rupees, but in a statement issued by Mocatta & Goldsmid as of July 22, 1926, the reserves in silver coin and bullion are shown as 94 45/100 crores of rupees. A crore means 10 million ounces. Of the 95 crores it would seem that 8 crores is in bullion and 87 crores in rupee coins, and based upon a rupee

containing .3438 fine ounces of silver, and on the Commission's valuation of 1s. 6d., or 36 cents, with silver at 62 cents an ounce, we arrive at the following tabulation, showing 259,606,000 ounces of fine silver available through reduction of reserves:

8 crores = Rs. 80,000,000 worth of bullion.
At 36 cents = $28,800,000 worth of bullion.
At 62 cents = 46,450,000 ounces of bullion.

87 crores, less 25 crores to be retained in the reserve after the 10-year period =

62 crores = Rs. 620,000,000 (1 Rs. = .3438 fine ounces).
At .3438 = 213,156,000 ounces of bullion.

46,450,000 ounces.
213,156,000 ounces.

259,606,000 ounces silver available through reduction of reserves.

"Quoting from page 49, Volume 1, of the Commission's report, paragraph 123:

'The official witnesses in India have submitted estimates tending to show that the total amount of rupee coin at present in issue is from 350 to 450 crores.'

"Taking the latter figure, and deducting from it 150 crores as the amount which, in their opinion, could in no event be spared from circulation, the Commission comes to the conclusion that an amount of rupees, 250 crores, may be regarded as that part of the rupee circulation which does not primarily serve monetary purposes. The figure of 250 crores includes rupees 95 crores of silver coin and bullion now held in the paper currency reserve, the ultimate disposition of which (95 crores) has been considered above.

"Rupees 250 crores less 95 crores leaves a balance of rupees 155 crores which may come out of circulation. Should the total amount of rupee coin at present in issue be taken as 350 crores instead of 400 crores, the amount which may come out of circulation would be reduced (50 crores) from 155 crores to 105 crores.

155 crores=1,550,000,000
At .3438 = 532,890,000 ozs. of silver
105 crores=1,050,000,000
At .3438 = 360,990,000 ozs. of silver

"The above amounts of approximately either 533 or 361 million ounces of silver may be made available through the reduction of the total rupee coin in issue. This report, therefore, seems to show that there are 259,606,000 ounces of silver available through the reduction of reserves as recommended by the Commission, while a minimum of approximately 360,990,000 ounces of silver may come out of the silver rupee circulation, making a possible total of 620,596,000 ounces that within the next 10 years India could place upon the market. If the present amount of rupee coin is taken at 400 crores instead of 350 crores, 532,890,000 ounces of silver would be added to the 259,606,000 ounces available from the reserve, making a total of 792,496,000 ounces."

In the National City Bank's letter of September 2, the amount of silver available to be sold by the Indian Government is stated as 687,000,000 ounces. We may, therefore, estimate there is 700,000,000 ounces, which India could place upon the market in the next ten years if the report of the Royal Currency Commission is adopted. This is about three years production of the entire world and ten years production of the United States.

Effect of Proposed Policy

India is today, and so far as our knowledge goes has always been, the world's greatest purchaser of silver. The American Bureau of Metal Statistics for 1925 estimates that in that year the world produced 241,000,000 ounces of silver and India imported 107,000,000 ounces more than she exported; in other words, India absorbed over 40 percent of the world's total production.

India and China together in 1925 took about 60 percent of the world's production of silver, and so far in 1926 have absorbed nearer 70 percent. The Royal Commission states that India normally purchases about one-third of the world's annual production.

These figures startingly portray the importance of India to the silver industry. It is true the Government of India itself has not been a large buyer of silver for several years; but if that government not only ceases to occupy the position of a potential buyer but actually becomes a seller in large amounts, can the effect be other than detrimental and far-reaching? Will not China be forced to follow, sooner or later, the example of India? Who will buy the silver India used to buy as slowly and remorselessly the amount of its purchases decrease? Who will buy the six to seven hundred million ounces India may offer to sell? Can there fail to be a further drastic decline in price if the recommendations of the report become law?

The exact answers to these questions can not be given but one general answer applies to all and is perhaps sufficient for our purposes and that is that the effect can not but be to lower the price of silver.

In the early seventies Germany abandoned the free coinage of silver but retained a subsidiary silver coinage. In 1873 the United States followed the same policy. Silver at this time was selling for over $1 per ounce but the price fell—with many ups and downs it is true—but on the whole fell until it reached the extreme low in August, 1915, of 47.16 cents per ounce. Then silver began to rapidly rise in price during the war, reaching its high of nearly $1.33 in January, 1920.

But during this long period of 30 years when silver, with many ups and downs, continued to steadily fall in price, the people of India and China never for a moment lost their confidence in silver but remained steady and consistent buyers.

But we are now confronted with the avowed purpose of the Indian Government to sell around 700,000,000 ounces of silver over a period of 10 years. This, as already stated, is approximately the world's present production of silver for three years. If sold in 10 equal installments, there will be sold each year, about the yearly production of the United States itself. The effect on the price of silver can not but be adverse and far reaching. It must result in a considerable fall in the price of silver with a corresponding rise in the price of gold.

The effect of a rise in gold will be world wide. It would necessarily follow because of India's increased demand for gold for its gold standard purposes and the substitution of hoarding gold in place of silver in India; for just as the people of India no longer hoard silver, they will to some extent and probably a very great extent at first, substitute gold so far as possible.

A rise in gold means an era of falling prices; an era when creditors will gain and debtors lose since it will require more of commodities to pay off a debt than was required when the debt was incurred. With the great problem of the payment of international debts staring the world in the face today, what will be the consequences of a further emphasis, through India's action, in enhancing the price of gold?

Special Effect on India

India, as we have seen, has been buying approximately one-third to 40 percent of the world's annual production. There are few reliable statistics on the subject but it is probable that this ratio has continued more or less throughout the ages past. No one knows how much silver there now is in the world including all ornaments and hoards, as well as coin. We can only form the crudest estimate which is that 10,000,000,000 ounces represents a reasonably probable figure—it may be twice that amount. At 60 cents an ounce the world's holding of silver is worth probably between 6 and 12 billions of dollars. It is probable that from one-third to 40 percent of this amount is held by the people of India and the price of silver affects the centuries old holdings and savings of the people of India more than any other nation. In fact, therefore, India must chose between the loss on one hand of a large portion, if not a very large portion, of its hoarded wealth in the shape of silver; and the benefits which it expects to derive from the new system.

Effect on the United States

So far as current production of silver goes, any fall in price affects the United States more than any other nation. While India and China have by far the largest amount of hoarded silver, the United States is by far the greatest current producer of silver. At least 60 percent and possibly more of the world's present production of silver is owned by Americans who are largely interested in the mines of Canada, Mexico and South America, as well as those of the United States. The gross value of the silver production owned by the citizens of the United States is close to $100,000,000 every year at the current rate of production with silver at 65 cents per ounce.

The United States is also a large holder of silver. There is in the United States approximately 500,000,000 silver dollars in addition to $250,000,000 worth of smaller silver—halves, quarters and dimes. The total coinage of the United States in fine silver represents between 400,000,000 and 500,000,000 ounces. The holdings of the people of the United States in objects of art and ornament, what is generally known as sterling silver, may amount to as much more. If silver falls in price the value of these holdings will proportionately decrease. The diminution in value is not compensated by any receipt of benefit or in exchange for some other thing of value but is a total loss, an actual obliteration of that much wealth without return and without substitution.

Effect on all Countries

So far as their silver hoardings are concerned, all other countries of the world will suffer proportionately and in the same way.

But in addition to this destruction of wealth by reducing the price of silver, there will be imposed upon the world at large, an actual additional expense which is not generally realized or understood outside of the mining world and that is that just as you reduce the value realized each year from the world's silver output; to a proportionate extent must you increase the price the world has to pay for copper, lead and zinc.

Over two-thirds of the present production of silver comes from the mining of these metals. Silver, in that mining, is largely a by-product and if that by-product becomes less valuable, it requires no argument to disclose that copper, lead and zinc must, in the proportion silver decreases, command a higher price in order to permit of their extraction for the purpose of mankind.

Let us consider the importance of this result to the world and especially to the United States which is the world's greatest consumer of copper, lead and zinc. Over $100,000,000 is now realized each year from the value of the by-product silver obtained in mining these metals.

In other words, of the total cost of producing the copper, lead and zinc now used by the world, $100,000,000 per annum is borne by the silver which is found in association with them. Forty percent of this silver is bought by India and another 30 percent by China. Neither India nor China use much copper, lead or zinc. The increased cost of copper, lead and zinc, then, must be borne by those countries which do use them, namely, United States, England and Continental Europe. In ultimate effect, therefore, the proposed Indian policy will increase the cost of copper, lead and zinc and will transfer the burden of bearing this increase from Asia, where it now lies, to the United States and Europe and in return nothing will be gained by anybody, anywhere.

People absorbed only in their own interests may feel some indifference as to what happens to the hoards of silver held by the people of India or to the people of the United States who have silver holdings, but they should reflect that their very indifference will cost them for their copper, lead and zinc, more per annum than what it now costs in exact proportion as silver declines; that what India and China now pay in reducing the cost of copper, lead and zinc, indirectly through their purchases of silver, will be borne in large part by the people of the United States and that the money which the people of India are now paying for silver will, if the object of the Royal Commission is fully achieved, be in large part spent for gold which will cause a rise in the price of gold.

In a diminution of the world's price of silver, therefore, we have two principal results:

1. An enormous loss to the present holders of silver which has been produced throughout the ages and which is now held in the form of works of art, ornaments, hoards and coin; and

2. Any fall in the price of silver necessarily increases in exact proportion the amount which the world must pay for its copper, lead and zinc.

Should not the world at large be anxious to find some method to preserve the value of 6 to 12 billions of dollars worth of silver accumulated through the centuries, as well as the current world production and by preserving that value reduce the amount it has to pay for copper, lead and zinc necessary for the maintenance of our civilization?

Should not the United States be particularly and especially active in asserting its influence through its Treasury Department, the Federal reserve bank and the executive power of the President, in preventing any action that will so seriously affect its own holdings and the welfare of its citizens?

This brings us specifically to the title of this paper:

What Can be Done for Silver?

Briefly, three things:

1. Prevent the threatened action of India;

2. Foster the resumption of subsidiary coinage in Europe as currencies of various nations become stabilized; and

3. Carry on the propaganda for increasing the use of silver in the arts.

Let us first consider the views of Mr. F. Y. Robertson, vice president in charge of metal sales of the United States Smelting, Refining & Mining Co., one of the three largest producers of silver in the world. Mr. Robertson is a close student of silver, a man of ripened experience and judgment and his views are entitled to the most careful consideration:

> "I can not believe that the psychology of the people of the earth, and especially India, will permit of silver being permanently demonetized. It has been a measure of value along with gold since the first history of man's financial events, and I believe that it always will be so considered. If silver is token money, gold is token money, and if we keep our faith strong in the belief that the peoples of the earth will insist on pieces of silver instead of pieces of paper, recognizing the real intrinsic value of silver, silver will be considered one of the precious metals along with gold all through the ages.
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> "We have not only got to educate our financiers and the Washington administration as to the value of silver as a crutch to gold, but to enlist them on our side. This missionary work should also be done by the members of the convention now in Denver, with their home bankers, and through the home bankers a knowledge of their interest in silver to their banking correspondents in the East, and it is my belief that if a bureau of propaganda on the value of silver for use in the subsidiary coinages in the currencies of the world was started by the mining associations for the education of their bankers throughout the country, it would have a most beneficial effect. The American financier, while keenly alive to all information that affects his own particular line, is oftentimes lamentably ignorant on just such questions as the silver situation brings up, because it is just outside of the line of his vision, and he is so concentrated on his own pots to keep them boiling that he has no time or inclination to interest himself in the status of silver.
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> "I believe that many, if not all, of the European countries will still use silver for their subsidiary coinage even if the report of the Royal Commission is adopted, and the argument that these nations should use silver for subsidiary coinage as against token coins, thereby strengthening their national wealth in gold with a reasonable amount of silver, can not be controverted. The experience of all the warring nations proved that with

every nation the gold went first for the purchase of the nation's necessities, secondly silver, and thirdly the written promises or obligations of the nation. These are facts that you can not get away from, and I believe should be most thoroughly propagated, not only in this country but throughout the world, and the best propagandists we can obtain are our foremost financial men, all backed by a general sentiment of the people, and the banking fraternity especially. Not only great care must be taken to avoid any indication of bimetallism, but it should be freely and openly stated that there is no thought of considering silver upon a parity with gold on any basis. Silver has a worth and a value of its own, and I prophesy that when silver ceases to be a measure of value, gold will likewise fade, at least to a very great extent.

* * *

"In addition to the immense loss that the Indian population would suffer on account of depreciated values of silver, not only United States and London financiers, but all Germany and other European nations view with alarm the danger of the depletion of the gold reserves of the world by placing India on a gold basis. There is no excess stock of gold for the world's financial requirements with both China and India left out of the picture, and should India be placed on a gold basis it would unquestionably force China to demonetize her silver currency and go on a gold basis, and the amount of gold that would be hoarded by the population of these two countries would be an unquestionable menace to the world's gold supply. Therefore there is still some hope that the recommendations of the English Royal Currency Commission may not be adopted in full unless some provision is made to establish silver as a legal tender for at least reasonable amounts such as would be common and customary in the financial transactions of the Indian population. If this legal tender phase for small amounts of silver, say, up to $50 or $100 was established, it would go a long way toward creating a feeling in the minds of the Indian population that silver still had values. Of course, it would have no effect on the rajahs and others who are holding immense amounts of silver bullion, but to my mind it would undoubtedly tend to keep six or seven hundred million ounces of silver now in Indian circulation off the market and reduce India's demand for gold."

The Indian Situation of Paramount Importance

Obviously, activities in behalf of silver should be directed first and primarily to the Indian situation and to the modification of the Royal Commission's report.

Fortunately we have time, short but perhaps adequate, if we do not delay. It is said that the report of the commission will not come before the Indian Parliament until April, 1927, and we have until then to marshal our forces and to adopt a line of action.

Under international law one nation has no right officially to dictate or attempt to control the type of currency used by any other nation. That is a matter of domestic concern only.

None the less, in these days, unofficially and indirectly, no step is taken among the great civilized nations without more or less conference with the financial authorities of other nations. Thus we see that the Royal Commission obtained the viewpoint of Governor Strong, of the Federal reserve bank, and the attitude of the United States upon the subject was of deep concern to it, for obviously, owning over 50 percent of the present supply of free gold in the world and having the greatest source of credit in the world, the attitude of the United States is very potential and influential in all matters of finance today.

What is primarily needed is a retention in India of the exchangeability of paper rupees for silver rupees and a decision not to sell any portion of its present holdings of silver by the Indian Government. If the United States through its Treasury Department and Federal reserve bank, aided by the great banking houses of the United States, strongly urges that this course be taken, it is probable that it will be done.

Here we should properly consider the effect of this action on the two motives underlying the desire for a change in the Indian currency.

The first motive, as we have seen, is the fear of a rapid rise in the price of silver such as took place in 1918 and 1919, and of the difficulties which were then incurred. But the United States saved the day in that emergency and it is very proper that in consideration of the change in India's policy which the United States desires, that it should agree that whenever an emergency arises it will sell silver to India or to the English Government, at a price below the melting point of the silver rupee. And the silver industry of the United States; every mining company in the United States, should and would contract and agree with our Government that in case of any such emergency, the silver produced by it (and remember the United States produces over 60 percent of the world's production) will be sold at a price to be fixed by our Government, not higher than the melting point of the silver rupee and not less than, say, 70 to 75 cents per ounce. Such an agreement might be entered into for a period of 10 or 20 years as might be desired. During that time advances will be made in the reconstruction of European currencies and time will be given to work out a system of Indian currency without injury to silver that will meet with the then conditions of the world.

In this way the fear underlying the desire for a change in the Indian currency would be assuaged and the principal motive for the proposed action, satisfactorily removed.

The proposed sale of Indian silver is probably based upon a desire to realize the money necessary to purchase the gold for the proposed Indian currency. It may well be questioned, whether, provided the Indian Government is protected as above outlined against the danger of a sudden rise in the price of silver, the necessity for further steps in establishing a gold standard other than that which now obtains (which is and for many years has been, in effect, a gold standard). But if it is desired to establish the so-called "gold bullion standard" recommended by the commission, then the necessary gold can be obtained by the issuance of bonds rather than by the sale of India's silver. The United States, not as a government but through its citizens, would readily purchase these bonds if the general plan met with the approval of our Government, just as we have purchased the German bonds to rehabilitate their monetary system and just as we have purchased French bonds and bonds of other nations from time to time.

Another object of the Royal Commission's recommendation is that of discouraging the habit of the Indian people of hoarding the precious metals. But the proposed action of the Royal Commission can not have any great effect in this connection. As we have seen, India in 1925 purchased 40 percent of the world's current output of silver and 50 percent of the world's current output of gold, and both the gold and silver so purchased was not used in the monetary system of India but was used solely for the purpose of hoarding. If now you diminish the value of silver for this purpose will not the people of India all the more demand gold for hoarding purposes? And where is the gold to come from? Here, again, we recall the fact that through all history, whenever governments became unstable through war or revolutions; whenever their credit from any other cause becomes impaired, the people at once fly back to their age long tradition of hoarding gold and silver. India is in an unstable condition. It is torn by religious dissensions between the Moslems and the ancient Hindu religion. It consists of many tribes of different nationalities, speaking some 27 different tongues. It is restive under the English rule, but is not advanced to a point where it can govern itself.

While these conditions remain it is not probable that the people of India will rapidly depart from their age long custom of hoarding—they are too ignorant, too suspicious of government and governmental promises, too pessimistic because of the thousands of years of rapine and plundering to which they have been subjected, to readily give up their attitude

toward gold and silver. One must learn to creep before one walks; to walk before one runs, and this is as true of nations as it is of individuals.

Is it not a mistake at this crucial time in the world's finances to attempt to radically change the well established customs and habits of a great people?

Adoption of Subsidiary Coinage

Next to preventing the Royal Commission's report from becoming law, the most important thing that can be done for silver is for our Government to use its influence to promote the adoption of silver for subsidiary coinage in the European nations as, one by one they rehabilitate and reestablish their currency systems. Here, again, as in the case of India, the power and influence of the United States and of its financiers, is very great. As France and Italy and Belgium and the other countries call on the United States for financing from time to time, the opportunity should be seized to encourage the use of silver for subsidiary coinage purposes just as is demanded by the common people of those nations.

Here again, let us recall that the proposed action by the United States and its financiers, both in the case of India and European nations seeking for financing, is all essential in the cause of silver. Let us again remember that the United States is more interested in the silver industry than is every other nation and that the problem now before us is to save to the people of the United States, the $100,000,000 per annum which they are now obtaining from the silver industry; is to prevent the great depreciation of the silver held by the United States Government and by our people; and is to save the people of the United States from paying for their copper, lead and zinc, the increased amount which they must pay if the value of silver which comes out with those metals, is materially lessened.

The third and perhaps the least important, but none the less important, of all the things that can be done for silver, is that of enlarging and fostering the use of sterling in the United States. Silver miners joined with silver manufacturers during the last year in a publicity campaign. This has already produced excellent results. Some 3,000,000 ounces more were sold for the purposes of sterling silver in 1925 than was sold in 1924 and so far 1926 promises to make a similar increase. But somewhat paradoxically the use of silver in the arts is dependent upon its value. A tin spoon, or a tin tea urn is just as useful as one made of silver and if tin were today worth more than silver we doubtless would see the use of tin where silver is now used. As, therefore, the price of silver declines, its use in the domestic arts will similarly decline. People want silver for their tableware and their ornaments, not alone for its intrinsic beauty but because it is an age-old mark of wealth, of social status and therefore gives a pride of possession to its owner. Destroy its intrinsic value by lessening its use for money and you correspondingly destroy its use in the arts. Therefore, success in increasing the use of silver in the arts requires the retention of silver for monetary use and maintaining the price.

Before the report of the Royal Commission the path of silver seemed rosy. Its use was increasing for monetary purposes and as its value enhanced, so also, increased its use for purposes of the arts. We must therefore, primarily, as a starter, get back to the happy situation which existed before the Royal Commission's report was published and that can be accomplished only through the influence, official or unofficial, of the United States. It behooves every silver-mining company, every stockholder in a silver-producing mine, every financier interested in the welfare of the United States, to get behind this movement. The friends of silver in the United States Senate and House of Representatives should voice their attitude in no uncertain terms. Everyone interested in silver should take pains to lay the facts before financial people with whom they are connected. Already our Government and our chief financiers in New York realize the importance to the United States of maintaining the value of silver. The report of the Royal Commission itself indicates its profound regard for the advice of the governor of the Federal reserve bank and that it was largely through this advice that the more drastic plan which had been presented to that commission and which would have in effect demonetized silver entirely in India, was not adopted but the modified plan was substituted. It will require but little additional effort on the part of our people and our Government to preserve the present situation.

This is no attack upon the gold standard. None of the old problems of 1896 are now presented. The issue is clearly cut—shall not the United States use its influence to preserve the value of silver and the prosperity of its citizens without in any way impairing or affecting the advantages of the gold-standard system? If those who are interested in silver act promptly and expeditiously in this crisis the evil which threatens may be overcome and silver will again resume its onward march of prosperity and of value.

SAVING THE IRON THAT GOES UP THE STACK

ABOUT 75,000 tons of iron ore is lost yearly in the Birmingham, Ala., district in the form of flue dust escaping from the blast furnaces, states the Bureau of Mines, which has conducted a study of the subject. The flue-dust losses in this district will average 250 pounds per ton of pig iron produced. On the basis of the present rate of pig-iron production, the annual loss of flue dust exceeds 300,000 tons. The iron content of the dust probably averages 25 percent, and the loss of iron from this cause thus amounts to about 3 percent of the iron mined in the district. By the use of magnetic concentrators of various kinds, it is considered that much of this loss can be prevented.

Flue dust, which results from the smelting of ores containing appreciable quantities of fines, is one of the troublesome products of iron blast-furnace practice. Gases issuing from the furnaces at a high velocity carry small particles of coke, ore and flux into dust-collecting chambers. These particles constitute the flue dust. Losses of iron ore through the production of flue dust vary between wide limits in the different furnaces, and depend on a number of factors, such as size and design of furnace, amount of fines in the ore, the operating conditions and the blast pressure.

Blast-furnace operators of the Birmingham district keenly realize this waste. The ores are comparatively low grade and require more fuel than is ordinarily used elsewhere. Hence the flue dust is low in iron content and high in coke. As a result it is not in suitable condition for direct sintering. In many other iron and steel centers direct sintering is a common practice. In the Birmingham district efforts have been made to prevent this loss by recharging the dust into the furnace, but, as might be expected, a material fine enough to be blown out once will very likely be carried over again.

The operators of the district are endeavoring to prevent this waste, and it was at their request that the Bureau of Mines undertook this investigation.

The high content of gangue in the average flue dust of the Birmingham district makes it unfit to treat in the same manner as those of other districts where direct sintering is sufficient to produce a satisfactory product, state Oscar Lee, B. W. Gandrud, and F. D DeVaney, in a report of the investigation just issued.

Copies of Serial 2761, "Magnetic Concentration of Flue Dust of the Birmingham District," containing the detailed results of this investigation, may be obtained from the Bureau of Mines, Department of Commerce, Washington, D. C.

LABOR QUESTION IS DOMINANT IN COAL

The Prolonged British Strike And Labor Unrest In Germany Give Our Non-Union Mines A Foreign Trade Which Advances Prices—A Stronger Market Tempts Union Mines To Resume Complicating A Tangled Labor Situation—Lewis Gives His Opponents A Leader

By GEORGE H. CUSHING

SEPTEMBER developments have caused labor relations to be the dominant question in the coal industry. Other issues are big but the labor question is bigger. Those developments are:

First—After the British mine strike had continued for 20 weeks, Premier Baldwin made a proposal embodying three suggestions. One of them was tantamount to conceding a nation-wide agreement, if the miners, in turn, would take into account "the economic facts of the industry." The miners refused to consider any proviso; thus the British strike has been prolonged. This serves to continue for a period, the demand for American coal overseas.

Second—Because the export market is absorbing, temporarily, our surplus production, the market price of non-union coal has risen to within a few cents of the production cost in the unionized portion of the field—to within 25 cents to 35 cents a ton. With cold weather approaching; with the season of heaviest shipment at hand; and, with the export market still active, some unionized mines, which had remained closed for a year to 18 months, have resumed production, and are paying the Jacksonville scale. This action has brought to an end, until next spring, any discussion of any proposed reduction of union wages. It has taught the miners to believe that the scale is not prohibitive. It seems almost unavoidable that this circumstance, otherwise insignificant, has laid the foundation for another great struggle between the operators and miners on the first of next April.

Third—Having come into the possession of papers which disclosed a tentative contract with one of the operators, John L. Lewis called together the proper board of the United Mine Workers of America and induced it to declare vacant the office of president of the Illinois miners. This position had been held by Frank Farrington, who had contracted to work for one of the operators if he should lose or quit his union job. Owing to the long standing differences between Farrington and Lewis it seems inevitable that this will result in a struggle within the Union, which can only serve to prevent it from taking any effective action on anything until after the biennial election in December. The strength of the following of both men is such that the impending dispute might, easily, divide the Union—a possibility which has been growing through four years.

Fourth—With England out of the world market; with Germany moving rapidly into a disagreement over wages; with the Union field unable to act on vital wage questions; and, with the Union in danger of division, it is evident that the non-Union field has before it, in the domestic and world markets, a bigger demand than it can conveniently satisfy.

Because of the seriousness of these four situations, it is clear that labor has become and will remain for months the dominant question in coal. If one were inclined to philosophize on such situations, his conclusion must be that the unions, by involving the United States, Great Britain, and Germany in labor trouble concurrently, are working against themselves. Certainly, unionism is not advertising itself to the non-Union districts. And, since the latter are now profiting, and will continue to profit by these labor troubles, there isn't much chance that the non-Union field will voluntarily surrender its independence only to court the trouble which, obviously, is the one sure concomitant of union affiliation

Taking up these subjects in the order of their importance to the United States: It is obvious that the British coal strike means far more to us—strange as it may seem—than it can possibly mean to Great Britain. That is to say, in England this strike involves mainly a matter of wages and working conditions. It is a local dispute over local issues between the miners and the coal owners. According to Mr. J. G. Bradley, who has just returned from seven weeks spent in England, there England's coal deposits are, broadly speaking, divisible into three large producing districts. Under the present scale, and prevailing world prices for coal, one of those districts can make money; a second can avoid a loss; and, a third must stand a sure loss. Conscious of this difference in conditions, English coal owners have suggested that wages be fixed in future by districts instead of on a national basis. The inference behind that proposal is, clearly, that miners who are employed in the more profitable field could be better paid; that those who work in the most difficult field might have to take less or to work harder; and that the other field might come to have, in time, an intermediate scale. The inference was unmistakable that the owners were suggesting to the miners that they share with the operators the natural advantages and disadvantages of the producing district and that they share, also, the burden of keeping the whole of the British coal industry alive. It wasn't altogether a question of scale; indeed, the scale was of minor importance. Instead the same suggestion was raised in England that the anthracite industry made a year and a half ago—if there could be greater efficiency, the need to stress wage questions would be minimized.

The miners were deaf to any such idea. They insisted that negotiations should be confined to wages and that those be considered nationally or not at all. The Union demanded but one scale —that a miner be paid the wages of a miner wherever he might work. Mr. Baldwin's proposal evidently had in mind that if the Parliament should set up a regulatory board it might approve a higher wage in the district where conditions are more favorable; on the contrary, in the third field, where the operations are conducted purely to salvage the coal in the ground without hope of profit to the operators and without offering more than mere employment to the miners, his evident thought had to do with modified terms. Therefore, a simple question of relationships as between the fields is the only question at issue; that is purely local and has no possible international significance.

Exactly the same question assumes far greater significance when it is seen from the American point of view. Over here, it is a question whether, under either proposed adjustment, England can hold its world trade. That, to us, is a big question. One cost of the World War to America was the development of more coal mines than we could conveniently employ in times of peace. That is, we had, through three and a half years, to take care of our own need of coal and then to satisfy foreign demand which was complicated by reduced production and enlarged consumption. That gave us more mines than were necessary to satisfy our purely domestic demand. Since we built many mines for export purposes, we have been looking constantly forward to the prospect of some day developing an international trade which would supply an outlet for part of our surplus production. Our introduction into even a fragment of the foreign market was delayed until the British strike occurred. Then those who couldn't get the British coal to which they were accustomed had to turn to us

or to Germany. The figures which tell what has happened are not dependable because they are not, as yet, complete. But on superficial returns it does seem true that the bulk of the business has gone to Germany; only an unsatisfactory fraction of it came here. However, we have been selling a very sizeable tonnage of coal abroad—mostly non-Union coal—and this business shows a disposition to grow as the prospects of labor troubles in Germany increase. It has always been true that even a temporary introduction into a market, in a large way—no matter what the cause—has resulted in a permanent occupancy of that market, in a fractional sense. That is, bituminous coal had to supply all of the anthracite market last year during the strike. It has since enjoyed a fraction of that market. If the general rule applies in this case—and it must—it follows that if we have to take England's place in a foreign market for a while and if, a little later, we have to supplant Germany, we will hold, in perpetuity, a fraction of that larger world market. The issues in foreign labor troubles may, therefore, be purely local to their countries but the result may easily be our introduction into a broader world coal trade—not as much as we ought to do, but more than we had reason to expect at once.

When you see the international coal situation in that light, it takes on many of the aspects of a conspiracy by the unions of the world to build up in America an impregnable non-Union coal mine organization. That idea is reinforced and strengthened by a concurrent development in this country. That is, when the coal operators and miners were assembled at Jacksonville, Fla., to negotiate the wage agreement, now known as the Jacksonville scale, the operators said to the miners and to each other:

"We will sign this contract because we must. But, to do so is to commit business suicide. We can't pay the proposed scale and then sell the coal for enough money to come out even. That must mean that Union mines will be forced to close down and that the non-Union mines will do the business."

Two years and seven months later, it must be admitted that that prophesy has become history. The Union mines *have* closed down; the non-Union mines *have done* the business. Therefore, many of those who signed the agreement have committed suicide; they have become bankrupt. No single fact in history is more clearly established. For over two years and a half, the operators have been telling the Union that they can't pay the Jacksonville scale. For two years and a half, the Union officials have been saying that it wasn't the scale, but something else in the industry that was withholding prosperity. There was a division on that point. Meanwhile, proof had kept piling up in support of the operators' statements; day by day the Union members were inclined to modify their attitude toward the scale. They did not begin to change until the British strike occurred and until we got an overseas market. Then the surplus production of the American mines was taken off the home market; the movement of that extra coal occupied some of the surplus railroad cars; and the incidental delays at the ports further destroyed the car surplus. As a result non-Union prices, at the mines, began, slowly, to rise. After five months those prices have risen to the point where they approach the cost of production in the Union field. That is, the non-Union coal can be sold at a profit at a little less than the actual cost of production in the Union field.

Recently, some of the Union operators in Ohio became convinced that the British strike will continue indefinitely; that labor difficulties in Germany are probable; and that we will have, through the winter, a brisk demand for coal in the overseas trade. It seems to them likely that prices, already on the upward trend, will rise still higher; maybe, even Union coal can be sold under these extraordinary conditions at a small profit. Therefore, a few of the Ohio operators decided to resume production. They decided to pay the Jacksonville scale.

If the Ohio incident is studied in the light of its own facts, it can have but one meaning. That is, the Union field and the non-Union field have been side by side through the two years and seven months during which the Jacksonville scale has been in force. In that long period, the non-Union field has been growing; the activities of the Union field have been diminishing. The vital difference between them was that the Union field paid the Jacksonville scale; the non-Union field paid a lower scale.

The second fact is that non-Union production was so large and was increasing so steadily it required a combination of the anthracite strike and a prolonged strike in Great Britain, plus a dispersion of railroad cars, to create such a market situation as would bring their price on coal up to within 25 cents to 35 cents a ton under the cost of production under the Jacksonville scale. The clear proof is that the Union field is laboring under a handicap; is permanently a differential field, so long as the Jacksonville scale shall stand. No temporary market situation can change those facts—they are too well established to be overturned.

It is unfortunate that the resumption of Union mine activities in Ohio is not viewed in the light of those established truths. On the contrary, the Ohio incident has been distorted and discolored into a tremendous movement in favor of the Jacksonville scale. The Union has deliberately ignored the influence of the strike in Great Britain, which creates our overseas trade; it ignores the possibility of a strike in Germany, which may increase our overseas trade; and, it does not mention the growing difficulty to supply cars on the American railroad. It sees only the rise of price but not the cause for it. The one fact which the union officials see fit to emphasize is that, under some conditions, the Jacksonville scale is being paid by mines which, recently, were idle. Therefore, they argued—as Mr. Lewis has continued to argue—that it isn't the scale that is holding back the trade; it is the selling price of coal. So, a strong movement has started among the unionized miners in favor of a renewal of the Jacksonville scale.

In any event, this misinterpretation of the situation has had two tremendous effects. It has stopped abruptly any and all negotiations which might modify the Jacksonville scale before its expiration date, March 31, next. This is of great importance because certain movements were under way which might have precipitated negotiations without waiting for the contract to expire by limitations.

It even seems possible that when negotiations for a new scale are resumed, the miners will be in favor of a continuance of the Jacksonville scale. It is enough to say that unless something can change the present trend of events between now and the first of next March, we may look for another struggle between the Union and the unionized operators.

As has been intimated, but one thing seems even likely to interrupt the working out of this doleful program. That one thing is the impending struggle within the ranks of the Union. Slumbering differences of opinion and methods of procedure between Mr. Farrington and Mr. Lewis have finally broken out into open discord. For a number of years, the Union itself has been divided into two camps—the radicals and those not quite so radical. This division in the ranks was sufficiently pronounced to threaten, in 1924, an open split in the Union and, possibly, a division into two unions. There has been talk of such thing during the last two years. The one thing which delayed the rupture more than anything else was the lack of a leader strong enough to head the secessionists from the international organization. Now it seems that Mr. Lewis has supplied to his enemies the very thing, the lack of which made him powerful. He has forced out of the Union the one man who is strong enough to assume the leadership of the opposition. And, Mr. Farrington is not without ambition.

Taking these various situations into account, there is ample justification for the assertion that the labor relations in the industry have become the dominant question of interest and must remain so for six months, at least.

SIGNIFICANCE OF APPLIED GEOPHYSICS IN MINING

A Review Of The Various Geophysical Methods Giving An Idea Of The Possibilities Of Their Application, Their Advantages And Weaknesses—Present Methods Will Not Be Entirely Replaced By These Methods And The Geologist Will Not Be Superfluous

By GEORGE TUCHEL*

AMONG the achievements of science and technic for the last decade applied geophysics draws special attention. After many years of thorough experimental research reliable scientific and practical methods were developed which are today recognized as some of the important aids to practical geology and the mining industry. Geophysical methods are based on the different specific physical qualities of rocks and minerals. Among the geophysical properties which experience has proven as specially fitted are namely:

Density, magnetism, elasticity, the electrical conductivity of rocks and minerals.

The methods based on these physical properties are known as:

1. The Gravimetric (or method of measurements of gravitation).
2. Magnetic.
3. The Seismic and Acoustic.
4. The Electric Method.

While the first two methods measure the variations of the natural energy in the earth, the last two are served by artificial energies that are introduced into the earth's crust. All methods determine anomalies within the theoretical field of energy or deviation if energy is introduced artificially. Consequently the defined anomalies that have been found have a purely physical character and for their interpretation in regards to geologic conditions in the subsurface extensive experience in the mathematical, physical, and geologic conditions of every kind of deposits is indispensable.

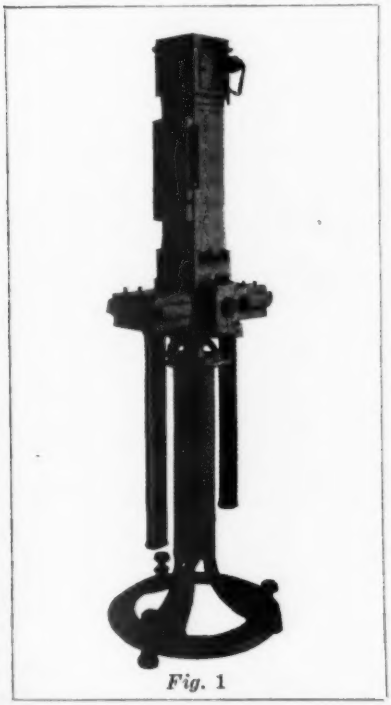

Fig. 1

In consideration of the confused idea of the public in regards to these processes it will be said that test wells or prospecting will not be entirely replaced by these methods nor will the activities of the geologist be superfluous, but the cooperation of the geologist is of greatest importance.

In the following by means of a few examples the different methods will be described, the theoretical basis of which only need be briefly summarized since a great deal has been published.

THE GRAVIMETRIC METHOD

The purpose of this method is the determination of the gravitational field of the earth, which shows variations due to the different densities and forms of deposits of rocks and minerals in contrast to a normal basic gravitational field. The variations are mass excesses or gravitational maxima if in the subsurface masses with a greater average density have been concentrated. Mass-deficits or gravitational minima are shown in areas in which less dense rocks exist. Thus as a whole the geologic conditions are reflected in the areas of mass disturbances.

Under the useful deposits in general ore deposits come forth as mass excesses, the salt and coal deposits as mass-deficits since the former is mostly made up of heavier and the latter of lighter minerals. The possibility of the direct finding of such deposits is apparently at hand. It is a different matter with oil which is only associated with certain stratas and hence has no direct effect on the gravimetric picture. But still the gravimetric method, as will be shown further on, is best suited for the finding of oil deposits. Among the instruments, which are used for gravimetric investigations the following designation is made:

The Method of Pendel Measurements, and,

The Method of Torsion Balance Measurements.

The principle of the Pendel method consists on the determination of the swinging period of a definite Pendel in different localities. Since these swinging periods are dependent on the gravitational force of the locality in question it is possible from such observations to calculate the absolute gravitational force. From the variations of these gravitational forces from a normal gravitational force conclusions can be drawn as to the attitude and condition of the subsurface masses. Work with the apparatus demands a great deal of experience and knowledge since for geologic purposes a very great accuracy in measurement must be accomplished which along with the precision of the apparatus above all is dependent on the ability of the observer.

Since the accuracy in measurement can scarcely be brought over to 1 to 1/2 units 10^{-3} (1/1,000,000 of the absolute value of gravity), the Pendel method will only be able to find an application where it is a matter of determining the greater geologic features, for example, the search for or pursuit of larger anticlines, covered upheavals of eruptive rocks,

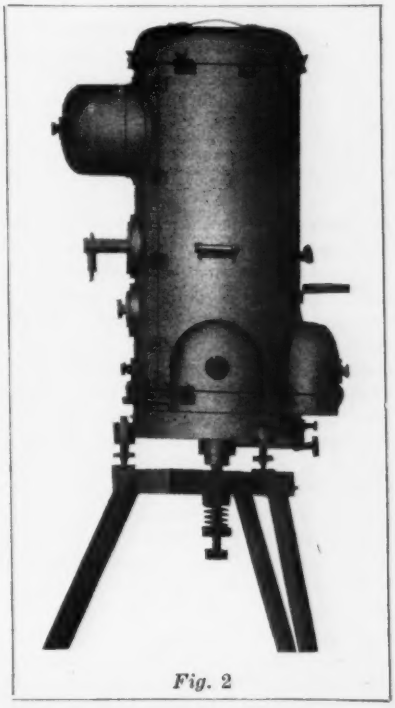

Fig. 2

*Mining Engineer, University of Berlin.

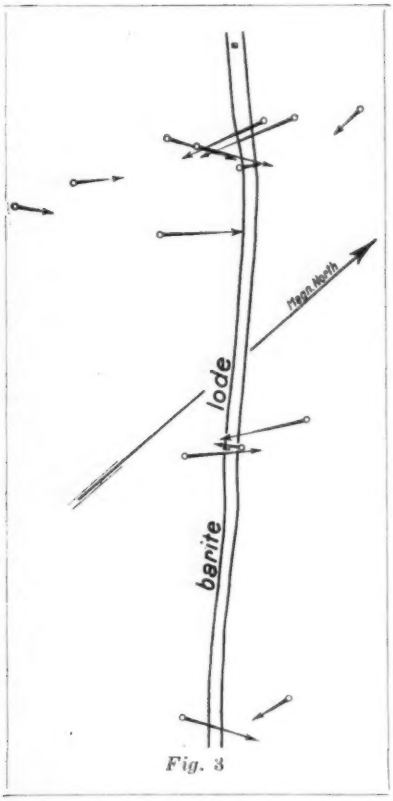

Fig. 3

tectonic Graben and Horst structures and salt stocks. On the other hand, the search for ore lodes or deposits with the Pendel is out of the question. Successful Pendel work, especially for practical geologic purposes, were carried out in Germany in the last years, for example, the work done by the Prussian State and the Industry in following out the uplift in Carboniferous formations in North Germany and the work of the Exploration G. m. b. H., Berlin, on the salt dome of Oldau Hambuehren. The method makes possible the covering of a great territory with speed, and still to gain comparable results at any points in contrast to the method of the Torsion Balance by which the possibility of the combination between values of measurements on different points of observation depends generally on the distance of the stations. In contrast to the Pendel Method which determines the absolute values of gravity, that of the Torsion Balance indicates the determination of the change in gravitational force in a horizontal plane and the curvature of levels of equal gravity. It gives the direction and the magnitude of the maximum increase of the gravitational force in the horizontal plane (gradients) and the direction of the slightest curvature of the gravitational level and the difference against the strongest curvature (values of curvature). The extraordinary sensitivity of this instrument makes it possible to carry out the measurement with exactness of 1×10^{-9} cgs., which value corresponds to about 1/1,000,000,000,000 of the absolute value of gravity.

Of the numerous types of Torsion Balances there are shown two of the most modern in Figures 1 and 2. In their construction advantage has been taken of the very wide-spread experience in field work of the North American Exploration Company. The balance shown in Figure 1 is a universal instrument which serves for the calculation of all values that may come in question, whereas the balance shown in Figure 2 is for all made for rapid measurements of gradients. Because of its small size and lesser weight it merits special attention. These instruments now make possible clearing up of geologic conditions particularly through the gradients which always point in the direction of the greatest increase in gravitational force which is determined by the stratification of the formations. The gradients are directed to the mass excess and they turn away from the mass-deficit. The magnitude and alignments of the gradients are determining for the direction of strike, the outline and the form of mass disturbance.

For the external application of this method the figures 3 to 9 shall be examples which best present the nature of these methods.

Figure 3 presents the results of the Torsion Balance measurements on a baryte lode near Saalfeld in Thueringen, Germany, carried out by the Exploration G. m. b. H. The lode was situated on a slope and lay with its outcrop about 5 feet under gravel slumpage. The thickness of the lode amounted only to 2.5 feet. It was known in the northwestern part of the map by a prospecting pit. The Torsion Balance measurements on this place plainly indicate a mass excess which was only to be explained by the greater density of the heavy "Baryts" in contrast to the relatively light country rock (Grauwacke). Further measurements in southeastern direction succeeded in establishing the continuation of this lode. The result of the Torsion Balance was later verified by digging pits.

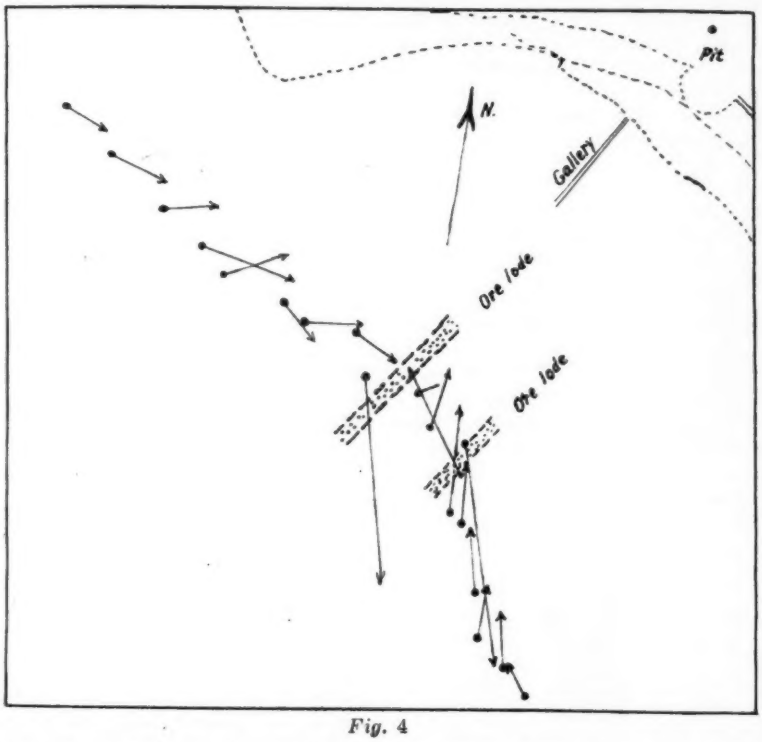

Fig. 4

In Figure 4 are shown the results of investigations of the Exploration Com-

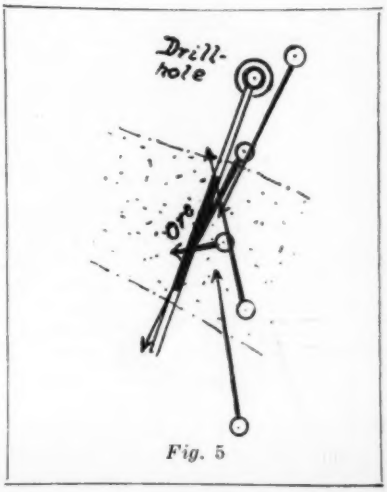

Fig. 5

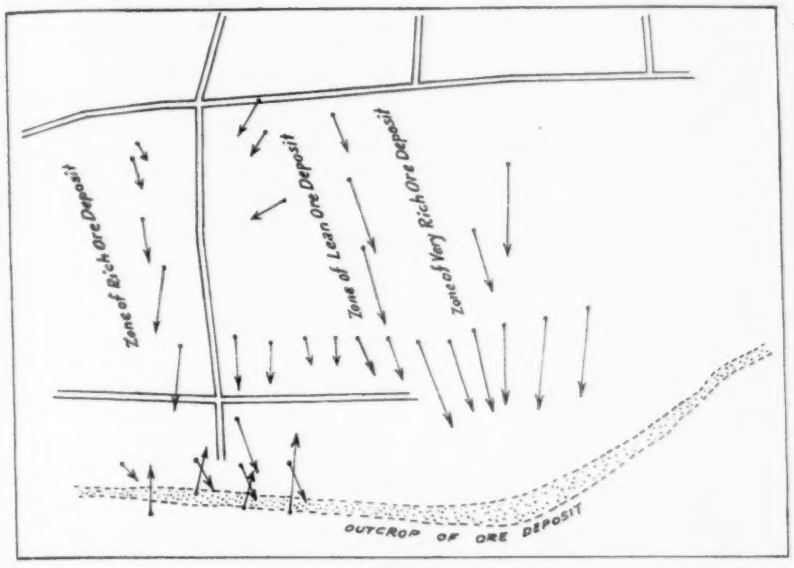

Fig. 6

pany in the Siegerlaend "Spateisen" territory, Germany (Mine Hahnbuegel). Here the problem was to pick up again through measurements on the surface the continuation of ore vein indicated on the map as discovered by a tunnel and which had been lost due to a fault.

The picture of the measurements makes possible the recognition of two mass excesses which are due to denser ore masses.

In Figure 5 is presented another simple example of the proof of the existence of an ore deposit by means of the Torsion Balance. Here is dealt with the investigation of the exploration on sulfite ore deposits in northern Sweden (Vaosterbotten). The measurements are of even greater interest in that they were made on the frozen lake near Mensstraesk. The gradients here also show the attractive influence of ore masses. This ore deposit was later proven by means of the electric method and was confirmed by diamond drilling.

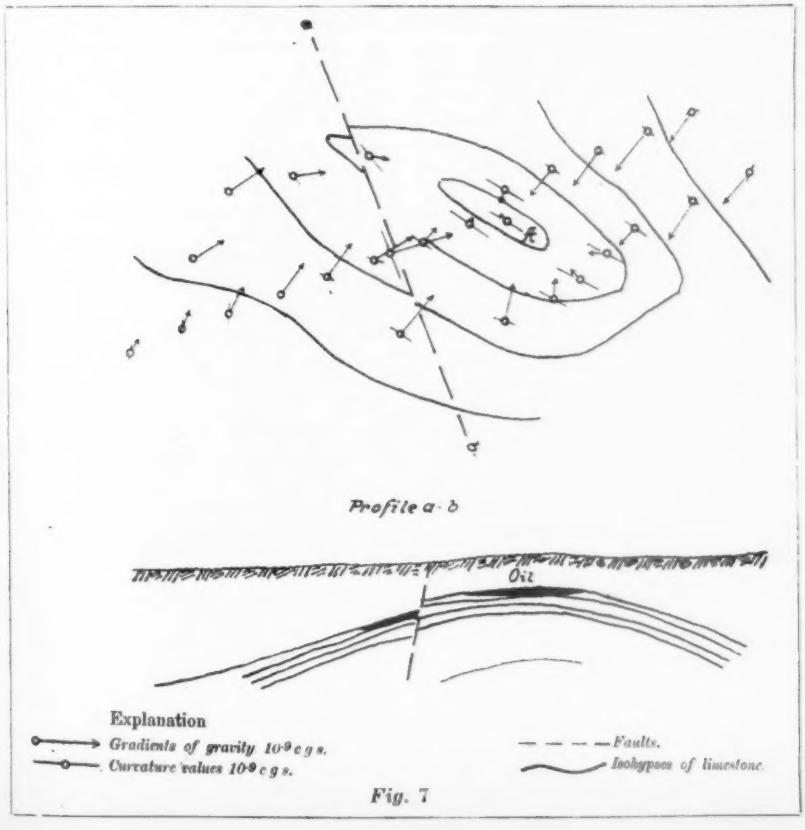

Fig. 7

Figure 6 shows an investigation carried on by the Exploration Company of an iron ore deposit in western Germany.

In the gravimetric picture the reversal of gradients shows clearly the pinching out of the covered ore deposits. From the magnitude of the increase of gravity in the different areas conclusions were made for the distribution of the ore masses.

The following figures 7, 8 and 9 show investigations on oil and salt deposits.

In regard to the importance of this method for the oil industry some remarks are to be made. As is well known, for the development of an oil field the most important preparation is how to get an idea about the tectonic, since the productive oil deposits are in the upper portions of folded formations in anticlinal arches in the broken stratas of larger zones of dislocations and in the upturned edge formations of many salt domes. It is this intimate connection of the oil deposits with the tectonic which makes possible gravimetric prospecting for oil. The folding or dislocation of the formations which are made up of separate members of different density, also causes the disturbance of the gravimetric field. The measuring of the distribution of gravity gives an idea of the subsurface structures. Thus the finding of oil deposits is possible from the recognition of the position and course of covered anticlines, as well as the specially abundant oil-bearing crest zone and domes can be located. It makes possible the finding and outlining of the salt boundary of salt domes and the establishment of great lines of weakness. For the promotion of the oil industry this method has similar significance as the knowledge won at the end of the last century as to the existence of oil in anticlinal arches.

Figure 7 shows the results from the investigations in a previously unknown American anticlinal area.

The gradient picture is typical for an anticline. Gradients as well as values of curvature (indicated by lines at the station point), clearly indicate the anticline proven by drilling as well as the position of its axis. In the convergence of the gradients in the direction "A" a dome-shaped uplift of the anticline comes forth. The profile brought out by the drilling stands in best agreement with the tendencies of the gravitational anomalies.

Figures 8 and 9 give the results of investigations on salt domes whose surroundings are known as oil productive. Figure 8 is the salt dome at Blue Ridge, Fort Bend County, Tex., and Figure 9 is the salt dome at Oldau-Hambuehren

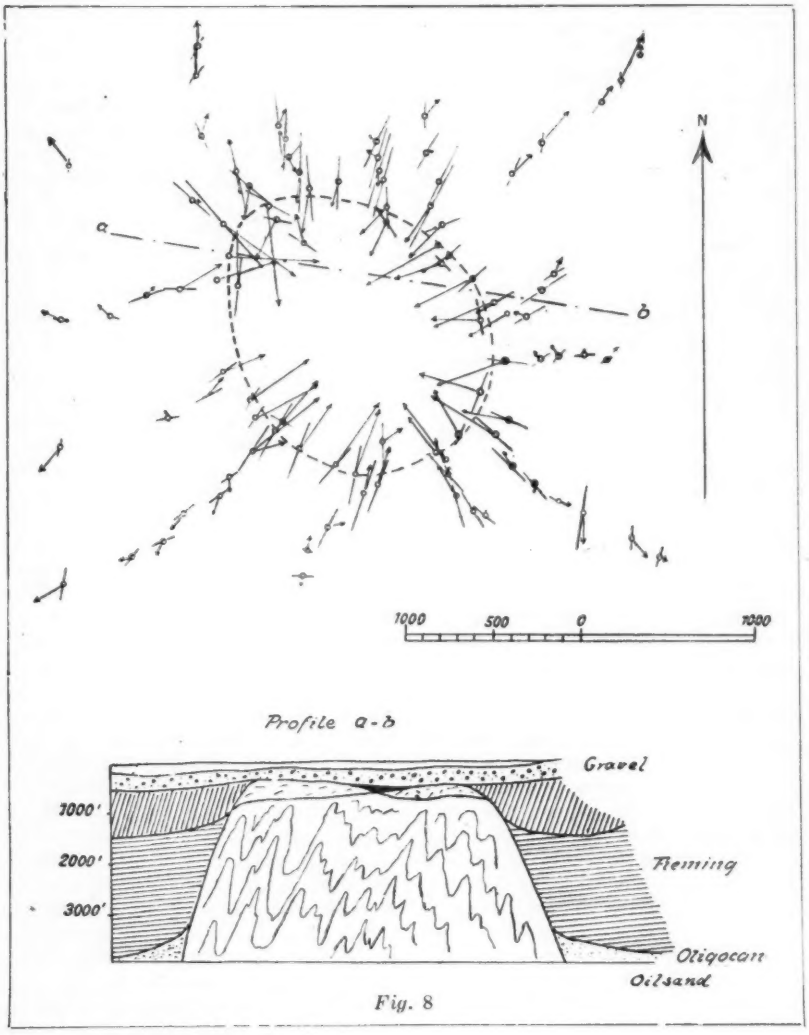

Fig. 8

Province, Hanover, Germany. Especially clear does the salt dome at Oldau-Hambuehren come forth in the gravitational picture as a mass-deficit (the gradients point away from the salt to the adjacent formations, while at Blue Ridge the denser caprock formations bring about the inner gravimetric picture). Noteworthy in Figure 9 is that the former salt boundary, taken by geologists on the basis of 30 wells, has a quite different course as that given by gravimetric investigations.

The Magnetic Method

The magnetic method is based on the different amounts of magnetization of the rocks and minerals. The strongest magnetic "susceptibility" is possessed by magnetite. Then follow in great intervals magnetites, hematite sulfitic ores. The latter already poss ss a relative minor magnetism.

Due to the lesser sensitivity of the magnetic instruments up until a short time ago, this method was limited to the investigations of very strong magnitite ore deposits—for example, Kirunavara, in Sweden. With the construction of more delicate and fieldworthy instruments the field of activity was greatly widened and extends now to slight anomalies. So the magnetic method has already been successfully applied in the finding of sulfitic ore deposits [refer Wagner: "Zeigschrift für angewendete Geophysik, Band 1, Häft 8, 1924] and for the outlining of basic eruptive rocks. For the oil industry it is of special importance since (for example, in Mexico and Japan) the oil deposits sometimes are in tectonic relation with basaltic intrusions. Furthermore, it should qualify itself for indirect search for mineral deposits with very little magnetism which are in contact with very strong magnetic eruptive rocks (for example, amphilolite, monzonite) or which are contained in such rocks as products of magnetical differentiation—for example, platinum, chrome and nickel ores in peridotites. Since precious metals of eluvial nature (gold, platinum) are often accompanied by magnetite, areas of greatest concentration of the metal can be determined by the increase of magnetism.

The investigations proper rest themselves on three elements of earth's magnetism, namely, vertical intensity, horizontal intensity and the declination. Heretofore two or more special instruments were necessary—for instance, the magnetical transit for the determination of the declination and of the horizontal variation. the sensitive Schmidt balance for vertical variation, Kohlrausch variometer for horizontal variation. Professor Koenigsberger has also developed three instrument types for the different problems.

Recently variometers (Figure 10) have

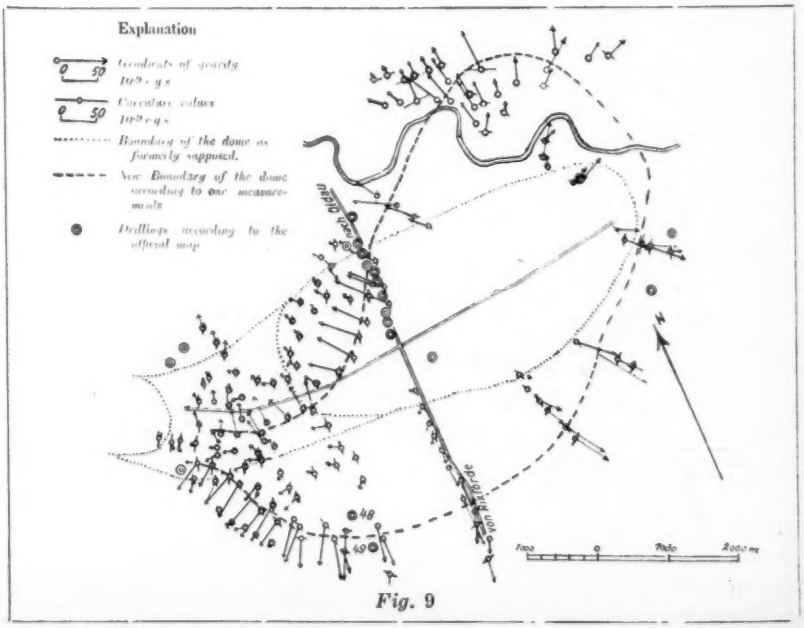

Fig. 9

been built by the Exploration G. m. b. H., Berlin, constructed by Dr. Haalck, which enable the determination of different values with only one instrument, whereby the speed of work of the magnetic investigations is much increased. The testing of this instrument by the Exploration Company gave extraordinary good results. Changes of temperature do not affect this instrument in the same degree as the older instruments. The first practical field measurement in America with this balance was made by the North American Exploration Company in the summer of 1926, for the search of magnetic ore deposits in the northern part of the United States, whereby this balance proved itself very good. Because of interest of the employer it is not possible to publish these results.

The much employed dip-needle in America only makes itself useful in the search of very strong anomalies, such as are called forth, for example, by extensive deposits of magnetite. Its application due to the lesser sensitivity and accuracy is very much limited.

The interpretation of magnetic measurements, with the exception of those on magnetite deposits, is difficult if the local geological conditions and the differences of susceptibility of the strata are not known. Magnetic anomalies can be caused by materials of totally different composition. Thus, according to Dr. Haalck, large masses with disseminated grains of ore can bring forth the same effect as small compact masses of ore, or several isolated ore lenses which are at a lesser distance from one another have the same influence as a single compact ore mass. Difference in the magnetization of formations lying closer to the surface can greatly influence the picture of disturbance and hence can lead to an erroneous interpretation.

The Seismic and Acoustic Methods

Both methods have as their object by means of the elastic conditions of the formations to gain a conclusion of the geologic conditions. The procedures employed by both methods are fundamentally different. While the seismic method occupies itself with the process of the furtherance of artificially achieved earthquake impulses, the acoustic method has the examination of the mode of action of acoustic signals (buzzing sounds, tones) which are transmitted through the earth's crust.

The elasticity of the formations and the points of mineral accumulation is dependent on the chemical mineralogic properties of individual parts and also the structure and texture of the rocks —for example, dense limestones have different elastic properties than loose chalk tuff (Travertine), shale banks a different one from slates. For the rate

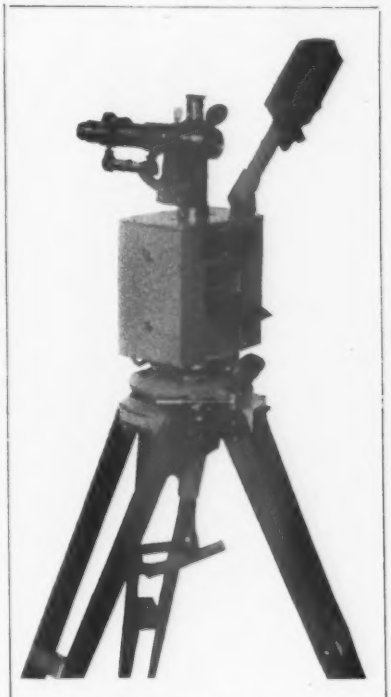

Fig. 10

of transmittal of the seismic and acoustic waves is dependent on the elastic properties of the formation.

In rocks of greater elasticity the speed of the waves is much faster than in those of lesser elasticity. So the eruptive rock (basalt, granite, etc.) shows a greater velocity than the denser sedimentary rocks and these again in turn greater than loose sediments. The knowledge of the numerical values of the velocity of the waves in the different rocks is of greatest importance.

The instruments used which in both these methods enjoy an application are in the case of the seismic method handy, still very sensitive, seismographs and by the acoustic methods sensitive membranes.

Since the acoustic method has not gotten out beyond the experimental stage and no results of practical experience are known, I will limit myself to the seismic method.

Aside from the mentioned seismograph whose movements are registered in an optical manner, recently apparatus based on an electric principle has been introduced into practical seismic prospecting by the North American Exploration Co., which in conjunction with the optical seismograph has well proven its worth. The determination of the wave velocity is given in the so-called "time curve," which represents the different intervals of time between the moment of shot and the arrival of the impulse of the surface wave. Since the waves not only run along the earth's surface, but in the deeper formations as well, the plotting of the results of the time curve gives an idea of the different velocities with which the waves traveled through different formations.

The accuracy of this method depends upon the interval at which the receiving stations are set. They generally have their places in a profile line. It is possible not only to determine the character of the subsurface formations, but also their depth if the conditions of stratification are not too greatly disturbed. This method has proven itself valuable in the finding of salt domes (since the salt has a greater elasticity than the nearby formations), in the determination of the thickness of overlying formations (for example, gravel or marl over palezoic formations) and in the investigation of prospects in the quarrying industry. This method has also worked with success in the defining of faults.

The application of this method comes in question when subsurface formations of great thickness alternate in lesser and greater velocities, or when formations of different velocities come to lie adjacent to one another. Difficult are the interpretations of the time curves in such an area in which the elastic properties of the formations change along the profile line, since the elasticity is different perpendicular or parallel to the bedding or parting in the formations.

The Electric Method

The electric methods are based on the knowledge of different values of conductivity of formations and minerals. The ores in contrast to the unproductive rock represent a relatively good conductor. In the scale of conductivity under the ores pyrite, copper-sulphide hold first place. Among the other minerals, graphite appears as a good conductor. The electrical methods have, therefore, value chiefly for search of ore deposits. The two most important methods are the galvanic method and the inductive method. With both methods an electrical current is sent into the ground either directly through electrodes or indirectly inductively introduced through an insulated cable loop or a cable which is laid out in the form of a circle. With the galvanic method between the two electrodes the intensity of the electrical current is observed by specially designed microphones and its distribution is shown on the map by lines of equal tension or intensity called equapotential lines. The presence of a disturbing body comes forth in the deflection of the measured equapotential lines from the normal course of potential lines. Over good conductors (ores) the equapotential lines will tend to go apart and will col-

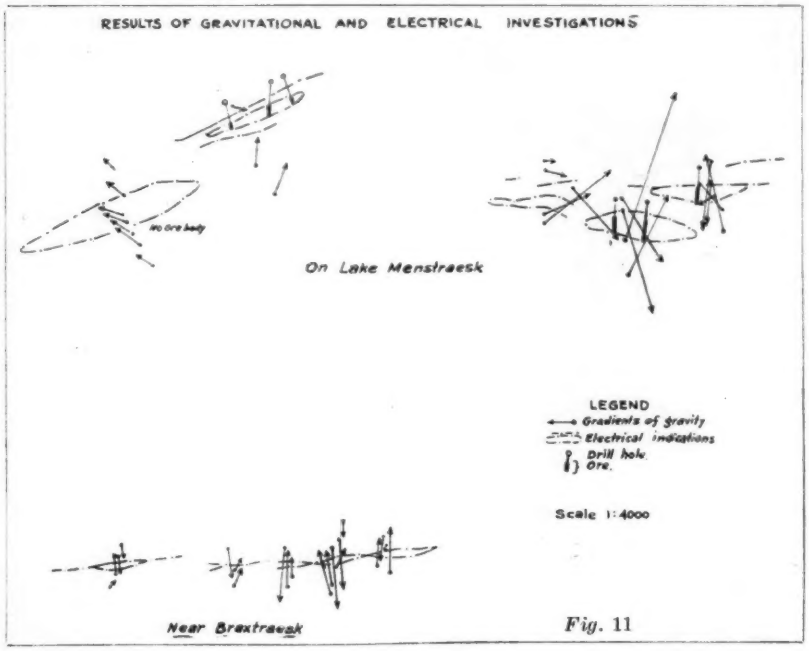

Fig. 11

Thus the geological and structural possibilities are reduced to a few cases and the interpretation of the surveying results becomes more reliable. For instance, if an anticline is located by the torsion balance, magnetical investigations may prove that the inner core is made up by igneous rocks. The nature of ore lodes found by electrical methods can be cleared up by magnetical instruments or the torsion balance may decide if an electrical indication is really a mass excess that will indicate perhaps an ore body or not. In many cases it will not be necessary to check a whole district to be investigated with two or three methods, but it will be sufficient to check the results of one method at an especially determined place by another method. By the combination it is possible to find the correct interpretation of the observed anomalies. Thus the best method for the continuation of the investigations can be selected and the interpretation (*Continued on page* 763)

lect themselves on the edge. By inductive method the direction of the field of energy will be measured by means of an induction frame. This method also makes possible the estimation of depth. By this the sulfide deposits in northern Sweden were well defined. The difficulties which often occur in the application of these methods are for all due to the influence of the surface of the country rock of the ore. Also the irregular distribution of moisture in the earth can cause misinterpretation.

This review of the various geophysical methods gives an idea about the possibilities of their application, their advantages and their weakness. The gravitational methods are the most universal, then the seismic methods follow, but they are restricted to a certain depth because the energies of explosions and sounds can not be increased over a certain limit. Magnetical and electrical methods are chiefly applicable for the investigation of ore bodies or deposits in some way connected with metalliferous beds.

Which method is best in certain cases can only be decided by the expert, who is extremely familiar with all of these methods. The experience gathered up until the present time, points to the fact that the future of practical geophysic will be the combination of different methods on the problem in question. The fact that the single methods are based on only *one* specific physical property of the minerals or stratas and that different minerals or rocks of different nature may have the same physical properties enforces in many cases the application of different methods.

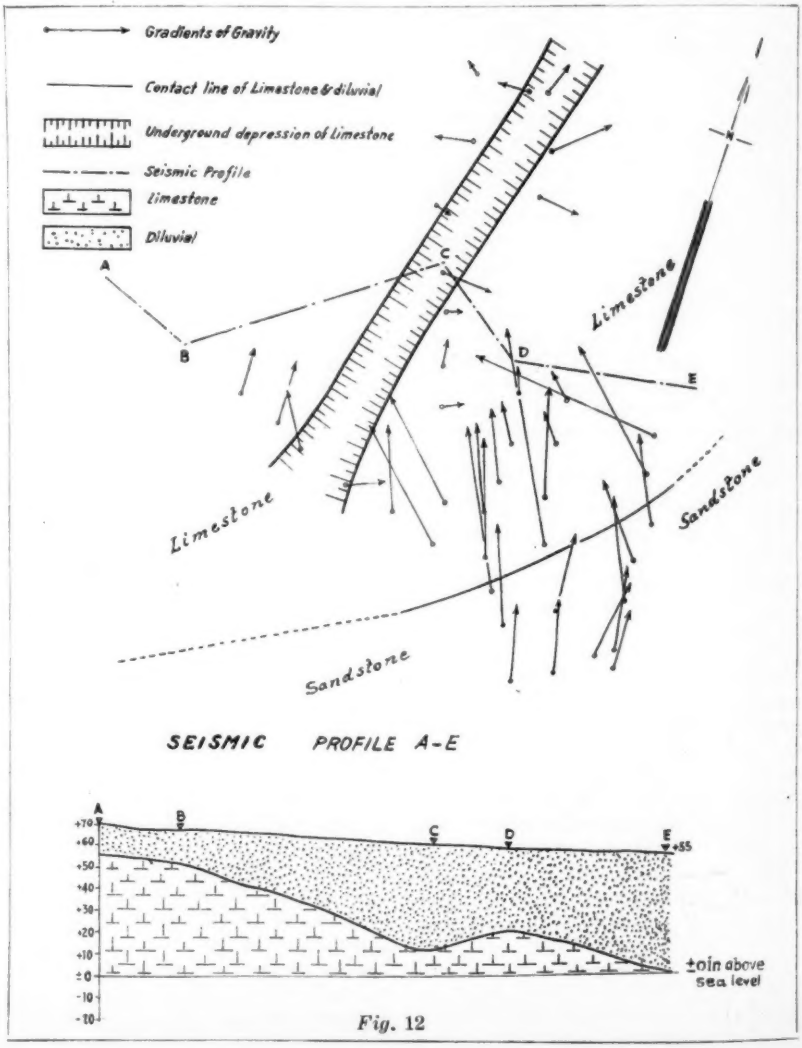

Fig. 12

Autumn along the old Chesapeake and Ohio Canal above Washington.

PRACTICAL POINTS ON ELECTRICAL PROSPECTING FOR LOCATION OF MINERAL DEPOSITS

Results Dependent On Conductivity and Position Of Ore Bodies—Geological Reconnaissance Essential—Sulphide Deposits Especially Favorable—Cost Usually Less Than Drilling—Nature Of Ore Body And Zones Of Dissemination Disclosed

By HANS LUNDBERG*

THE Swedish electrical methods of prospecting may now be considered generally known. During the last few years a great deal has been said and written about these methods and the success achieved, especially in Vasterbotten, Sweden.

However, the methods are generally described or demonstrated from a technical-theoretical standpoint. The practical miner who likes to keep in touch with new development in the mining industry certainly likes to have a number of questions answered.

The main questions, for instance, would be:

What is the field for electrical prospecting?

What is the relative expense of electrical prospecting, compared to other methods?

Will it be possible in the future for everybody to execute electrical prospecting?

In what way are the electrical prospecting methods going to be useful to the mining industry?

Without going too deeply into detail, these questions may be answered in a general way.

The main feature in analyzing problems to be solved by electrical prospecting is to make clear which ore bodies are likely to reveal themselves in an electrical survey. The electrical methods are based on the fact that ore bodies having greater electrical conductivity than surrounding rock and soil cause disturbances in electrical fields. Evidently the first thing to do is, therefore, to investigate the electrical conductivity of ore minerals and rock minerals. This may be performed by testing the specific resistance. A great number of these tests have already been made, and from these conclusions may be drawn that ore-bearing rocks such as granites, porphyries, quartzites, greenstones, limestones and others are practically non-conductors, having a specific resistance of more than 100 million ohms per cubic inch. On the other hand, native metals and sulphides of, for instance, copper, iron and lead, are very good conductors, showing a resistance of from a fraction of one ohm to a few ohms only per cubic inch. The conductivity of zinc blende varies considerably. Pure blende is a poor conductor, but as blende very often is associated with ore minerals of good conductivity, for instance, galena, chances generally exist for also finding zinc. Generally magnetite, specularite, cuprite and zincite, also are good conductors. However, the conductivity is not a conclusive character for possibility of finding an ore body. Geological conditions, distribution and occurrence of the ore mineral, etc., also are of importance. For this reason geological knowledge and a geological map of the locality is, as a rule, necessary. Only in case of searching for additional ore bodies around a developed mine may geological mapping be omitted.

If electrical prospecting is to be carried out on virgin ground, a preceding geological reconnaissance will limit the actually suspected area to a minimum, so that no electrical prospecting is carried out on ground which, for geological reasons, may be considered barren. Secondly, from the geological information, guidance is obtained as to which electrical method is most suitable. Furthermore, the electrical work will be facilitated, and conductive but non-commercial zones of mineralization may be avoided.

The general shape and character of the ore bodies also are of great importance. An ore body must have a certain horizontal area to disturb the electrical field. Great difficulties are sometimes encountered, for instance, in locating small ore bodies of the shape of steep-dipping chimneys or pipes.

The sequence of the formations is also of importance, and it is practically impossible to reach electrically an ore body situated underneath a layer of higher or equal conductivity than the ore body itself.

The greatest depth to which an ore body may be reached under favorable conditions is not quite determined. Up to the present, investigations, with reliable results, have been carried out on conductors situated 600 to 800 feet under the surface of the ground.

Now the question may be asked: What information is obtained from an electrical investigation?

The development of the methods has proceeded so far that it is possible to not only locate a conductive body of ore, but also by means of detailed survey to determine the shape and outline of the body and also the depth of same. This has been proved satisfactorily in numerous locations in Europe and Africa, North America and other localities.

It is possible, however, to go still further. By means of qualitative surveying, it is sometimes possible to form an idea as to the nature of the conducting body; if it is of solid ore, or if it has a banded schistose or disseminated structure. I refer to the history of the Bjurfore, Menstrask and Boliden discoveries in northern Sweden, where the methods chiefly have been developed.

These results were not achieved without great effort. Lengthy and extensive investigations had to be made. The fact is that in Vasterbotten, Sweden, occur, along with the ore bodies, zones of disseminations of pyrite and of graphite schists, which cause electrical disturbances, as do the ore bodies.

In the beginning it was therefore necessary to test all the electrical indications obtained, by means of trenching or diamond drilling, which became both expensive and time-consuming. Then it finally proved possible to develop the Swedish electrical methods so as to distinguish between indications caused by solid ore and those obtained on non-commercial disseminations and black graphite schists. It was this systematic and carefully conducted detail work that proved successful and also made the discovery of the new ore districts in northern Sweden.

Although sulphide bodies are most suitable for locating electrically, the methods have proved valuable also in prospecting for iron ores, such as magnetite and specular iron. Although the magnetite may be discovered by means of magnetic methods, the information gained from a magnetic survey is rather limited, which is quite natural, as a magnetic field is availed of, having no means of being varied. By means of an electrical survey, however, it is possible to direct the electrical field suitably and thus study various disturbances caused by the ore body, and obtain information as to the nature of the ore body. It is not unbelievable that in the future all magnetic indications will be made subject to an electrical qualita-

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tive test to ascertain if it is caused by solid ore or by dissemination.

As to the cost of electrical prospecting compared to other methods of exploring, it may be said that electrical prospecting is generally carried out by two trained experts with the help of four or five unskilled hands. The cost, of course, depends on the time required.

In the case of a reconnaissance survey, that is to say, with the main object of merely locating ore bodies without such detail work as may later prove warranted, the field cost would approximate $2,000 to $2,500 per square mile, where surface conditions are favorable. The cost, naturally, depends on topographical and geological conditions. The subject involves certain variables, but the figure will give an idea of the cost of electrical prospecting.

How does this figure compare with other methods of prospecting, namely, systematic digging of trenches, driving, sinking or drilling?

In making this comparison, we have disregarded the preliminary geological work by means of which the suspected area is limited. To take a concrete example, a review of the discovery of the Bjurfores ore field, Sweden, may be cited. A number of boulders were known. Geologists tried to determine the direction of the glacial movement along which the boulders had been moved from the mother lode. This is not an easy determination as, in fact, variations in the movement took place during different glacial periods. However, the direction was determined within 15 degrees.

Now, it must be kept in mind that the ore body was discovered about 1.5 miles from the last known boulder in the row.

Suppose that no electrical methods were available and that other methods had to be used in prospecting the area within which the mother lode could possibly exist: At first, digging trenches systematically through the whole area might be thought of. This, however, proved to be impossible, as the depth of the drift down to the rock surface is 22 to 30 feet, sometimes more.

Then, the only way left seemed to be drilling systematically the most probable area 0.3 to 0.5 square mile.

Naturally, it is difficult to estimate how much drilling would be required to find the ore body. Suppose the holes are placed so as to limit an ore body, say, 450 feet long, it would require about 8,000 to 10,000 feet of drill hole.

Figuring an operating cost of but $4 a foot, this investigation would involve a cost of $30,000 to $40,000.

In this case the electrical methods saved a great deal of money, in fact such a campaign of drilling would not have been entered upon and the deposits would not have been discovered because the geological evidence was too slight to warrant drilling expense, whereas the incentive was sufficient to risk the slight cost of electrical prospecting.

The cost of drilling and of the electrical investigation can not be compared directly, as drilling will be required in testing the electrical investigation as to grade of ore, etc. The figures, however, will, in a general way, give an idea as to the difference in cost.

The last question was: How are these new methods going to be useful to the mining industry?

When, in about 1918, these methods first attracted attention as being useful for finding certain ore deposits, the opinion was expressed that the procedure should be put in the hands of the public, thus serving the mining industry most ideally and bringing forward new developments more rapidly. This was mostly due to the general opinion that the methods were so perfected as to be utilized by everybody and that electrical prospecting was a simple and general procedure.

The more one digs into these problems the more it becomes clear that the field for electrical methods is more limited than was originally thought. On the other hand, it is found that by electrical methods in the developed state under certain conditions, questions of great importance may be answered, which previously could hardly be conjectured.

However, electrical prospecting of today is rather complicated. It is an art which requires experts especially trained and scientifically skilled.

The principal organization doing this class of work has now 20 especially trained and skilled engineers and geologists, all technical graduates, who execute electrical prospecting in different parts of the world, thus accumulating experience which individual electrical prospectors would hardly gain by more or less occasional experiments. This organization has at present teams working in North America, South Africa, Germany, Austria, Poland, Sweden and Norway. The electrical methods have been patented all over the world, to retain for the organization the free use and to assure the sound development of the methods.

It must not be concealed that several experiments made with electrical prospecting have completely failed. The reason for these failures undoubtedly is explained by the fact that the utility of the methods at first was generalized and over estimated, so that too much was expected of them. Previously it sometimes happened that electrical prospecting was carried out in places where conditions made a successful outcome impossible and where the work should have been avoided as inapplicable.

To assure a sound development of the electrical methods and in order to build up a good reputation, the organization always investigates very carefully the conditions for electrical prospecting before any engagement is undertaken. It discourages our methods where the conditions are unfavorable. To this effect, laboratories are established, where, in the first place, electrical characteristics of minerals and rocks are investigated. In doubtful cases, and in order to test the possibilities of the methods, investigations on a small scale are carried out under conditions similar to those met with in the field. These laboratories, of course, are a very important tool in the prospecting work with electrical methods.

AVERAGE RESISTANCE

(Expressed in Ohms per Cubic Inch)

Non-Conductors

Rocks: Granite, Gneiss, Quartzite, Porphyry, Limestone, Diorite, Epidote, Garnet	100,000,000

Varying Conductivity

Zinc (pure blende)	4,000,000
Zinc (black blende)	200,000
Zinc (complex)	10,000 to 100

Conductors

Magnetic ore	800 to 300
Specular iron ore	50,000 to 250
Galena ore	800 to 5
Sulphides of arsenic, iron and copper	5 to 0.1

THE MORE IMPORTANT PAPERS AND ARTICLES ON THE SUBJECT (IN THE ENGLISH LANGUAGE)

"Prospecting with Electricity," by H. R. Conklin, in Engineering and Mining Journal Press, August 25, 1917.

"Study of Electrical Prospecting," by C. Schlumberger, Engineering and Mining Journal Press, May 7 and 14, 1921.

"Experiments in Electrical Prospecting," by S. F. Kelly, Engineering and Mining Journal Press, October 7 and 14, 1922.

"The Results Obtained," by Schlumberger.

"Method of Electrical Prospecting," by S. F. Kelly. Paper presented at the Canadian meeting August, 1923, of the A. I. M. E.

"Practical Experience in Electrical Prospecting," by H. Lundberg, Geological Survey, Sweden; Year Book 16, No. 9, Stockholm, 1922; August and September of the Mining Magazine of 1923; Engineering and Mining Journal Press, April 5, 1924.

"Electrical Prospecting," in Mining Magazine, December, 1924.

"Frospecting by Radio," by W. C. Riley, Engineering and Mining Journal Press, November 8, 1924, and discussion by K. Sundberg, February 7, 1925.

(*Continued on page* 763)

Omega Hydraulic Mines, Nevada County

CONFLICT BETWEEN FARMERS AND HYDRAULIC MINERS

After Years Of Litigation And Strife Hydraulic Mining In California Sees Peace And Opportunity To Resume Operation—State Has Appropriated $10,000 To Investigate Rehabilitation Of This Industry Which In Its Heyday Boasted 425 Mines With An Investment Of $160,000,000

JAMES D. STEWART*

ON June 14, 1880, the Federal River and Harbor act carried a clause requiring the Secretary of War to have a survey of the Sacramento River made by the Chief of Engineers of the U. S. A., of the damage being done this stream and its tributaries by the debris from mines. The result of this examination was made in a report dated January 31, 1881.

On June 28, 1881, the Attorney General of the State of California began suit against the Gold Run Ditch and Mining Company of Placer County. This case was tried at Sacramento before Judge Temple and occupied 60 days. It was bitterly fought on both sides and the hydraulic miner lost at every turn during the trial and in the appeals which followed.

On January 23, 1884, Judge L. B. Sawyer of the United States Circuit Court in the case of Edwards Woodruff vs. North Bloomfield Gravel Mining Company, et al., of Nevada County, granted a perpetual injunction enjoining the defendants from dumping the debris from their hydraulic mines into the rivers.

Immediately deputy United States Marshals left for the mountain regions to serve the injunctions on all the operating mines. Consternation and gloom reigned among the mining population for up to this time the hydraulic miner believed that the farmers' attitude toward him was childish.

An example of his attitude toward the opposition is found in the Placer Herald (a weekly newspaper still published at Auburn) where reference is made to the forming of "hogs backs or sand bars in the Sacramento River from the Mining debris." It is dismissed lightly with the comment that "with the building of railroads the river will not be needed to carry freight." It is small wonder that while holding such ideas the hydraulic miner came to grief.

When the blow fell in 1881 there were 425 hydraulic mines operating in the Sacramento and San Joaquin basin, but principally on the Sacramento watershed, using a total of 10,650,000 24-hour inches of water. Careful estimates give an average duty of three cubic yards of gravel for each 24-hour inch of water. On this basis the hydraulic mines were discharging somewhere between 30 and 35 million cubic yards of debris into the rivers and canons each year. Less than 15 percent of this amount found its way to the navigable waters. The heaviest material lodged under the dump never to move; the smaller cobbles and gravels piled up in the rivers and later, when hydraulic mining ceased, channels were cut down through these deposits and the greater portion of them remain above the river bed to this day. The finer material caused the trouble.

While the hydraulic mines were operating the drift gravel mines were discharging a vast amount of the same material into the streams. Much of this was cemented and had to be crushed in stamp mills into sand, as is quartz, and all went to the lower stretches of the streams. In 1879 the Bald Mountain drift mine alone contributed 106,160 cubic yards to this mass.

The quartz mines also did their bit. In 1881 a census of the quartz mills tributary to the Sacramento and San Joaquin Rivers showed that there were 2,546 stamps crushing quartz. These stamps were crushing over 1,000,000 cubic yards yearly. All of this material was crushed into fine sand and all went down into the navigable waters. Wherever the hydraulic material lodged it made the finest of farming lands, but the quartz sand made a desert. Notwithstanding the fact that quartz mines were contributing fully 25 percent as much damaging material to the navigable waters as the hydraulic mines, they were not molested. The hydraulic miner felt the injustice of this discrimination keenly but, not wanting to see his neighbor enjoined also, he suffered the blame to be shouldered upon him.

For a time hydraulic mining ceased absolutely. Miners left for other parts and desolation and ruin reigned where prosperity had flourished. Some built make-shift dams to restrain the debris. Others defied the valley forces, for there were vast fortunes at stake. The testimony in the Gold Run Case showed that there were invested in the Mines of California about $160,000,000 over $100,000,000 of which was invested in the hydraulic mines. Six thousand miles of ditches and canals had been built at an average cost of $3,800.00 per mile, over 10 billions of cubic feet of water had been stored for summer use, and such a stake could not be lost without a fight.

When the hydraulic miners organized, the other forms of mining joined the associations and counseled moderation to save their own hides, until the hydraulic miner was finally smothered in moderation.

On the other hand the farmers organization, the Anti-Debris Association, was splendidly organized and presented a solid front. It had the backing of the Sacramento Bee, Marysville Appeal, the Colusa Sun and other strong valley papers. Probably no more able writers have lived in California than the McClatchys of the Sacramento Bee, and Will S. Green of the Colusa Sun.

The Anti-Debris Association was unbeatable. Where a dishonest watchman

* E. M., Auburn, Calif.

Tailings From The Dutch Flat Hydraulic Mines In Bear River. After 45 Years Of Winter Freshets The Deposit Is Nearly 100 Feet In Depth Yet, Only 20 Feet Having Been Washed Away

would have ruined any other organization, their very dishonesty was a help to the farmer. They were sent to the mountains to search out the illicit hydraulic mining. In many cases the hydraulic miner donated part of his clean-up and he was not reported. Soon self-appointed watchmen came out to get in on the good thing and, either the miner quit in disgust, or was reported and enjoined by some fellow whom he had not satisfied. In a number of cases murder resulted. And all this time the ditches and flumes and equipment of the hydraulic mines were deteriorating.

During this entire period each Legislature and Congress was petitioned for relief for the miners and in 1893, after two years' consideration, Anthony Caminetti, Congressman for the Second District of California, had his bill passed by both houses of Congress and signed by the President. This law known as the Caminetti act, has had in hand the regulation of hydraulic mining on the Sacramento and San Joaquin Rivers and their tributaries. It is administered by three officers from the Engineering Corps of the United States Army. The Caminetti act places the entire matter of hydraulic mining in the hands of this body, officially known as the California Debris Commission. The act provides that hydraulic mining may be licensed by this commission behind dams or other barriers constructed under their direction and approved by them. It also provides that this commission may build dams to restrain this debris and charge 3 percent of the gross yield of the hydraulic mines for this storage.

For hydraulicing in violation of this law a penalty of fine and imprisonment, or both, was provided. Hundreds of applications to hydraulic were made and granted where the requirements were complied with. However the barriers were mostly of wood or brush and the Anti-Debris Association objected and injunctions were again the order of the day. A hydraulic miner secured a permit to mine from the Federal authorities and was stopped by an injunction from a State court issued from the county of the enemy. Chaos again ensued for the injunctions were served whether the storage basin was efficient or not.

Most of the hydraulic miners gave up and quit but a few hardy souls persisted, for there were people in the Valley who were fair and willing that the hydraulicer should operate if it could be done without injury to the river and adjacent lands. The State appropriated $400,000.00 and Congress a like sum to control the debris already in streams. The work was largely experimental. A bedrock foundation could not be secured for the barriers and they failed. Needless to say this was disheartening but the hardy few still persisted and at the last session of the California Legislature, H. C. Cloudman, Assemblyman from Alameda County, and a former resident of You Bet, Nevada County, secured the passage of a bill appropriating $10,000.00 to investigate the possibilities of rehabilitating the hydraulic mining industry. It provides that the money be spent under the direction of the Surveyor General, W. S. Kingsbury, and the State Mineralogist, Lloyd L. Root. This commission have secured the services of Arthur Jarman, a mining engineer, to make the survey and report to the next Legislature. Immediately on the appointment of Jarman, the California Debris Commission offered the services of its corps of engineers to make the survey for the dam sites, this offer was accepted and the work is now under way. Mr. Jarman is making a thorough survey of the gravels that can be hydrauliced and has met with cooperation from every agency that might be interested, notably the State Engineer, Flood Control departments, the Sacramento Chamber of Commerce, the Mining and Metal Producers Association, composed largely of the quartz mining interests, the California Development Board, the American Mining Congress, the Business and Farming interests of Marysville and Yuba City as well as every agency approached.

On the start the hydraulic miners as a whole were apathetic; today they are jubilant, not only with the thought that they are to operate their mines again but that they will be at peace with their neighbor and coworker, the farmer. The next and concluding article will deal with the benefits to accrue from resumption of hydraulic mining.

ARIZONA MINERAL PRODUCTION

Mine production of Gold, Silver, Copper, Lead, and Zinc in Arizona in 1925, by counties (In terms of recovered or recoverable metal)

Advance figures by V. C. Heikes, of the Bureau of Mines

County	No. of producers	Ore treated	Gold*	Silver*	Copper	Lead	Zinc	Total value
		Short tons	Fine ounces	Fine ounces	Pounds	Pounds	Pounds	
Cochise . .	53	2,593,876	67,443.31	2,316,531	146,468,392	18,707,288	6,745,392	$25,940,546
Gila . . .	32	8,512,562	8,990.06	628,625	175,613,783	263,658	189,440	25,596,600
Graham . .	3	161	5.81	417	191	41,740	.....	4,067
Greenlee . .	5	1,528,431	3,927.52	141,559	59,464,187	4,721	.....	8,623,756
Maricopa .	9	14,943	1,037.16	1,958	6,020	51,000	.....	28,091
Mohave . .	57	78,736	29,103.46	187,387	37,051	1,532,256	174,703	883,513
Pima . . .	48	3,367,586	14,725.11	272,947	74,783,386	897,057	23,750	11,192,911
Pinal . . .	46	3,286,347	10,689.71	890,322	102,858,322	574,546	.....	15,494,727
Santa Cruz	37	3,586	65.50	46.595	38,180	1,021,591	14,365	129,168
Yavapai . .	68	1,544,507	65,268.37	2,762,113	154,017,340	510,893	184,466	25,195,073
Yuma . . .	28	1,647	484 91	9,384	67,677	271,267	.....	49,746
Total 1925	386	20,927,382	201,740.92	7,257,868	713 355,129	23,876,017	7,332,116	†$113,138,198
Total 1924	275	19,820,505	235,995.74	6,649,276	677,752,013	18,642,314	.....	‡ 99,610,379

*Includes placer production.

†Average value of metals: Gold, $20.671835 per ounce; silver, $0.694 per ounce; copper, $0.142 per pound; lead, $0.087 per pound; zinc, $0.076 per pound.

‡Average value of metals: Gold, $20.671835 per ounce; silver, $0.67 per ounce; copper, $0.131 per pound; lead, $0.08 per pound.

METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

GUY N. BJORGE, Editor

Practical Operating Problems of the Metal Mining Industry

FLOTATION OF LEAD CARBONATE ORES OF THE WARREN MINING DISTRICT, BISBEE, ARIZONA

Ores Principally Siliceous—Selective Flotation Yields High-Grade Concentrate And Better Recovery—Results Of Gradation By Grinding—Character Of Water Important — Experience Indicates Many Established Practices Unnecessary

By I. H. STANLEY*

THE Bisbee District is the largest producer of lead in the state of Arizona. Most of the lead ore comes from the Mines of the Phelps Dodge Corporation and the Shattuck Denn Mining Corporation. Up to date most of the lead ore mined has been a siliceous ore carrying native gold, silver, chloride, and carbonates, oxides and sulphates of lead. The bulk of the lead produced has been from direct smelting ore.

The first concentration of lead carbonate ore in the Bisbee, or Warren Mining District, Cochise County, Ariz., was begun in the concentrator of the Shattuck Arizona Copper Co. in August, 1918, under the supervision of Mr. Glenn L. Allen, who worked out the metallurgy and supervised the construction of a concentration plant. It was July, 1919, before satisfactory recoveries of lead and silver were obtained by tabling and flotation. The concentrator was operated continuously from July, 1919, to December 1, 1920, when both the mine and mill were closed down.

A description of the flow sheet, equipment then used, and results obtained are given in an article by Glenn L. Allen, published in the Engineering and Mining Journal of October 16, 1920. The mill flow sheet of the operations in 1919 and 1920 is shown by Chart No. 1.

During the year 1920 there was treated approximately 300 wet tons per day in the Shattuck Concentrator from the Shattuck Mine, and the average heads, tails and recoveries for that period are shown by Table No. 1:

TABLE NO. 1

	Gold Ounces	Silver Ounces	Lead Pct.
Heads	.0619	5.489	5.22
Tails	.0224	2.272	.535
Concentrates	.276	22.99	30.70
Percent Recovery	69.42	65.06	91.35

The ratio of concentration in 1920 was 6.418 to 1. On the 1920 flow sheet the best recoveries were obtained when the lead content of the combined table and flotation concentrates was approximately 30 percent.

While production of ores was resumed by the Shattuck Mine in February, 1923, due to the early termination of the Pittman Act, which ran out in June, 1923, and the expected low price of silver to rule thereafter, the concentrator was not operated until April, 1925.

As the decline in price of silver after the Pittman Act terminated more than off-set the profit that had previously been obtained from concentrating lead ores, experimental work was begun in the hope to improve results sufficiently to overcome the reduction in price of silver. The research work was done by the Shattuck Co., the Minerals Separation Co., and the Southwestern Engineering Corporation, and by March, 1925, it was believed that more satisfactory results could be obtained by straight flotation of the low-grade lead carbonate ore than had been obtained previously by tabling and flotation.

Therefore operations under the supervision of I. H. Stanley, mill superintendent, were resumed at the concentrator on April 14, 1925, and the revised flow sheet, as shown by Chart No. 2, was worked out by September, 1925, and operations continued up to date on flotation only. There has been eliminated the screening ahead of tabling, the primary tables, the regrinding, the secondary tables, the Allen cones, pumping for regrinding, the sand tables, and the thickening of the pulp ahead of flotation. The changes resulted in reducing milling costs nearly one-half as well as improvement in gold and silver recoveries.

No change has been made in the crushing and storage of the ore, nor rearranging of the mill equipment.

* Mill Superintendent, Shattuck-Denn Mining Corporation.

From the coarse ore bins the ore is conveyed and delivered to a No. 5 Telsmith Gyratory Crusher, which delivers to a 4-foot x 5-foot Hummer Screen, the oversize of which is delivered to a set of 42-inch x 16-inch Traylor rolls in closed circuit with the hummer screen, equipped with a screen cloth having one-half inch openings. The undersize is delivered to the mill storage bins. From the fine ore bins the feed is delivered by disc feeders and conveyed dry direct to two 64½-inch Marcy Ball Mills, where it is ground in closed circuit with Dorr Type "C" Drag Classifiers to 95 percent through 100 mesh.

The pulp is delivered at around 26 percent to 28 percent solids direct from the classifiers to one 8-cell Groch machine, where a primary gold-silver-lead concentrate is taken and run to the Dorr thickening tanks for filtering. About 45 percent of the gold and silver and 20 percent of the lead is obtained in this concentrate.

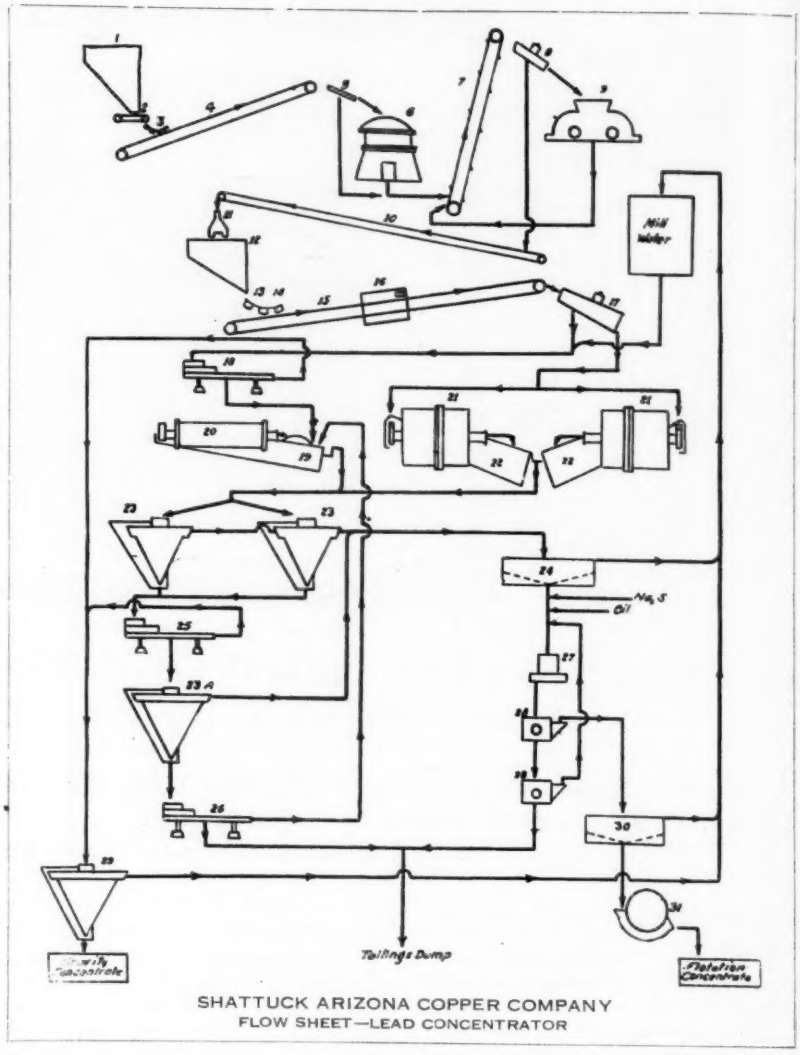
The tails from the Groch machine are delivered to a single Groch cell, which is used as a mixer for the application of the sodium sulphide and oils ahead of final flotation, and the feed from the Groch mixer passes by gravity direct to four Single Spitz K. & K. 10-foot flotation machines, where a high lead, low gold-silver concentrate is produced and sent to the Dorr thickening tanks, and the tails delivered by gravity to one Double Spitz K. & K. 10-foot flotation machine. A secondary concentrate is taken from the Double Spitz machine and delivered by pump to the head of the four K. & K. machines. The tail from the Double Spitz machine goes to waste.

When the lead content of the feed is low, an alternate method is used to maintain the grade of lead-silver concentrates. A rougher concentrate is taken from the four K. & K. Single Spitz machines and sent by pump to one Single Spitz K. & K. machine for cleaning, the tails from the cleaner flowing by gravity to the head of the four K. & K. machines.

The concentrates are delivered by a 3-inch diaphragm pump to one 8-foot diameter by 6-foot face Oliver Continuous Filter. The cake from the filter falls into a concrete bin, from which it is loaded by shoveling and mine cars into the railroad cars for shipment to the smelter at El Paso, Tex. There is no drying of concentrates after filtering.

Principal Factors

The principal factors that govern satisfactory recoveries are: Fine grinding, water of the proper alkalinity, proper pulp density to the flotation machines, selective flotation, proper reagents of certain proportions, and skilled operators.



SHATTUCK ARIZONA COPPER COMPANY
FLOW SHEET—LEAD CONCENTRATOR

Chart No. 1

Grinding to 12 or 14 mesh would release about 60 percent of the lead for tabling, and to 60 mesh would release the lead sufficiently for flotation. However, grinding to 95 percent through 100 mesh, which gives a product of 75 percent—200 is necessary to release the gold and silver, which is associated principally with the silica gangue. Therefore, as it is necessary first to take off a gold-silver concentrate, one grinding is made of the total feed to approximately 95 percent through 100 mesh.

The character of the water used is very important. The best results are obtained when the total alkalinity is approximately 13 grains per gallon. An excess of iron in the water is detrimental to both lead and silver recovery. If mine water is used containing copper in solution, the silver recovery is poor.

The use of sodium sulphide or sodium silicate, or both, in the circuit leaves a certain amount of gangue and reagents in suspension in the tailing water. While the water can be reclaimed and reused by settling with lime, there is required an increasing amount of lime and eventually a stage is reached when the lime has no effect. The only water now reclaimed is that obtained from the thickener tanks. The amount of new water used is approximately 800 gallons per ton of ore.

Experiments seemed to indicate that the use of reclaimed water settled with ferrous sulphate improved the lead recoveries but lowered the silver recoveries, eventually to where the loss in silver more than offset the gain in water saved and additional lead recovered.

The reagents that give the most uniform results and the best recoveries of gold, silver and lead are sodium sulphide, sodium silicate, xanthate, Lewis tar and No. 70 frothing oil. The quantity required of each reagent varies continually and the recoveries obtained de-

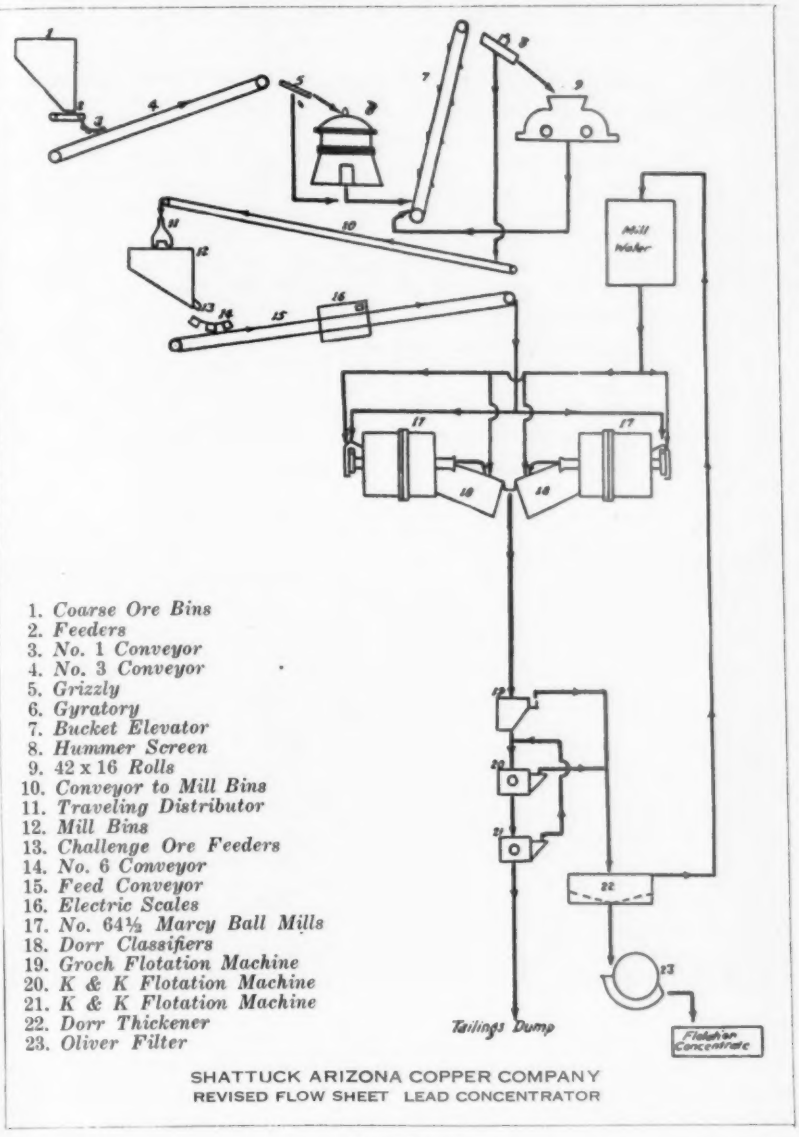


Chart No. 2

pend upon the skill of the operators in applying the reagents.

The average quantity of the reagents used is shown by Table No. 2:

TABLE NO. 2

	Per Ton Ore Pounds
Sodium Sulphide	2.0
Sodium Silicate	2.0
Xanthate	.1
Lewis Tar	1.0
No. 70	.75

The sodium sulphide and silicate will vary a half pound either way from the average. The Lewis tar will vary a fifth of a pound. The No. 70 about one-tenth of a pound. The xanthate is practically uniform. The use of xanthate seems to steady the results. No marked improvement in recoveries is obtained by its use, other than possibly in gold. The sodium silicate, xanthate and part of the tar and oils is put into the ball mills, the sodium sulphide and remainder of tar and oil in the mixer following the Groch flotation machine.

Recoveries on Revised Flow Sheet

On the revised flow sheet, Chart No. 2, and using the reagents specified, the results for the month of January, 1926, are shown by Table No. 3.

TABLE NO. 3

	Gold	Silver	Lead	Ratio
Heads	.107	6.84	6.10	....
Tails	.022	1.65	.55	....
Pct. recovery	81.6	79.1	92.30	....
Concentrates	.823	40.19	39.02	6.932

These results are according to mill assays, which check reasonably close with results based on smelter returns.

The ratio of concentration depends on the lead content of the mill feed. It is difficult to produce a combined concentrate higher than 45 percent lead. The recoveries of all metals are about the same on a concentrate up to 40 percent lead, regardless of the ratio of concentration. A 40 percent lead concentrate apparently can be made with as good recovery on a 4 percent lead head as on an 8 percent. The gold tail is fairly constant up to a head content of one-half ounce. The silver tail is not constant, even on a uniform head content. However, the silver tail rarely exceeds 2.5 ounces, even on a 12-ounce head. There is a gradual rise in the lead tail with the increase in lead content.

Facts Not Previously Known

Some of the matters that have been proven since operations resumed in April, 1925, using selective flotation instead of tabling and flotation, are as follows:

1. That equal recoveries can be obtained by straight flotation as by tabling and flotation.
2. That better recoveries and a higher grade concentrate can be obtained by selective flotation.
3. That grinding 95 percent through 100 mesh is sufficient to release the gold and silver, as well as the lead, for flotation.
4. That the recovery of the gold and silver does not depend upon finer grinding, but upon proper reagents.
5. That selective flotation is as cheap as tabling and flotation.
6. That a delay after the application of Sodium Sulphide before flotation is not necessary.
7. That thickening of pulp ahead of flotation is not necessary to good results.
8. That violent agitation in flotation is not necessary to good lead recoveries, but appears necessary to obtain satisfactory gold and silver recoveries.
9. That the use of Sodium Silicate reduces the amount of Sodium Sulphide required, and makes a higher grade concentrate.

The flotation of lead carbonate ores seems to be as much a matter of experience and skill of operators as the type of flotation machines.

However, it is believed that machines which depend as much upon mechanical agitation as on air, are the best for the flotation of lead carbonate ores.

The principal advantage in milling the low grade lead ore from the Shattuck Mine is the profit made from the direct smelting ore of high grade lead, copper and gold that is found as the milling ore is mined.

The concentrator of the Shattuck Company, treating a siliceous lead carbonate ore containing gold and silver by selective flotation, is the only one of its kind. The recoveries obtained are equal to or better than obtained elsewhere on lead carbonate ore using straight flotation, or tabling and flotation.

HEAP LEACHING SACRAMENTO HILL LOW GRADE ORE*

Effect Of Clay On Leaching—Average Copper Content Of Ore Treated Below Three-Quarters Of One Percent—One-Fourth Of Total Mine Water Diverted To Leaching—Recovery Costs Low

By A. W. HUDSON †

AMONG the various processes investigated by the Research Department of the Phelps Dodge Corporation for the profitable extraction of copper from semi-oxidized and pyritic copper ores, millions of tons of which are available in the Southwest, heap leaching showed considerable promise.

This method of copper extraction has been in use at Rio Tinto, Spain, for many years, where dense sulphide ores containing approximately 48 percent sulphur and 1.6 percent copper are depleted of their copper contents, the residual ore being sold on the market to chemical works for the manufacture of sulphuric acid.

Considerable sums of money have been spent by the Phelps Dodge Corporation in research and experimental work making small and large scale tests by this method.

It is generally known that ore dumps or tailings piles after exposure to air and rain for years have only a small amount of the contained copper rendered soluble. Experimental work demonstrated that one of the essential factors in heap leaching necessary for releasing the copper, or for converting it into soluble form, is the presence of iron in the leaching or wetting solutions, and tests have shown that under proper conditions a high percentage of copper can be extracted from lean silicious ores.

It is known that some rocks, due to the composition of the gangue present, disintegrate rapidly under atmospheric conditions and especially so under the severe conditions of repeated wetting and drying with solutions containing acid and iron. Rocks that so disintegrate, especially those that contain kaolin or clay, prohibit leaching by preventing percolation of the solutions and oxidation in the heap.

Results of churn drilling done at Sacramento Hill showed that there would be available large quantities of silicious ore containing copper of low grade. A large quantity of such material was already in a dump, having been obtained when sinking the Sacramento Air Shaft.

Also at the Burro Mountain Branch, at Tyrone, a quantity of ore, obtained during development over a period of years, had been piled in various dumps adjacent to the shafts and tunnels.

There was sufficient ore at either place to supply enough for a working scale test, the mining cost of which had already been paid. Laboratory tests indicated that good extractions could be obtained from both of these classes of ore.

It was decided that heap leaching tests would be made at both Bisbee and Tyrone on the ores available, and consequently 10,000 tons of the Sacramento Air Shaft dump averaging 1.33 percent copper were moved on to prepared ground at Bisbee, and 20,000 tons averaging 2.71 percent copper moved and piled at Tyrone.

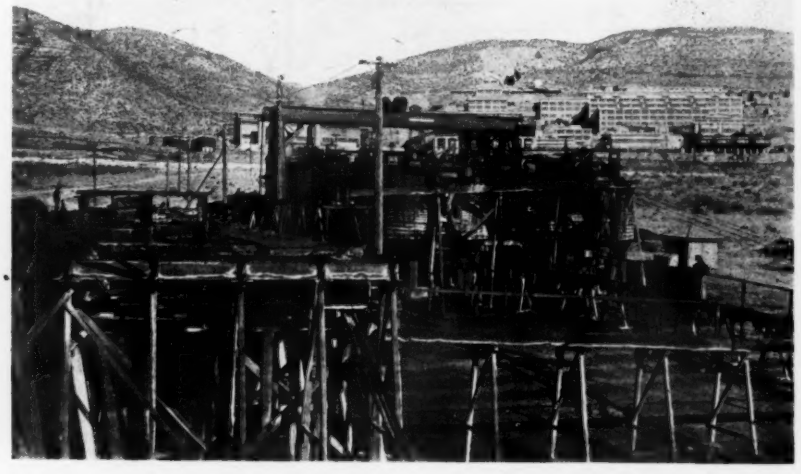
Both heaps were under treatment for three years, the extractions for that period of time being: Bisbee, 45.2 percent of the copper, and Tyrone, 38.6 percent, the figures being derived from the measurements and assays of solutions both on and off the heaps. Percolation was good with both of these heaps, the Bisbee ore showing less disintegration.

About this time stripping operations were to commence at Sacramento Hill, and it was apparent that large quantities of material would be encountered that would be of too low grade to be profitably treated at the concentrating plant, and since the cost of delivering this to leaching heaps would entail no more expense than putting it over a waste dump, it was a favorable opportunity to grade and separate this material and put it into heaps for treatment. As there would be no cost of mining, the only risk by heap leaching was the cost of the plant.

It was therefore decided to separate and treat this low grade material by heap leaching.

In steam shoveling Sacramento Hill the product is graded into four classes, viz, (1) waste, (2) low grade ore, (3) concentrating ore, (4) smelting ore.

The second grade is classified as leaching ore and it is estimated that the deposit contains 8,500,000 tons of this material averaging 0.72 percent copper.



Concentration Plant With Concentrator In The Distance

LEACHING SITE

The leaching site was selected on account of its proximity to the ore, the contour of the ground, and the nature of the floor which consists of conglomerates and caliche.

After clearing the site of brush and cactus a railroad track was built along the north end of the site. The ore has been delivered in steel dump cars of 20 and 25 cubic yard capacities which dump either side of the track by the use of compressed air.

Dumping operations were commenced on the sloping ground south of the railroad and as the dump increases the track is thrown to the edge, the coarser rocks rolling down to the foot of the heap.

The large lumps are broken with powder to a size approximating 18 inches, some of which are used for the construction of culverts or drains. Fine

* Paper presented September meeting, Arizona Chapter, American Mining Congress.

† Phelps Dodge Corporation.

ore is used for covering the surface of the heap and constructing basins for irrigating purposes.

The culverts are used both as ventilating flues and drains for the solutions and are built ahead of the ore being dumped, a selection being made of the hardest rocks. Culverts are spaced from 25 to 50 feet depending on the depth of the ore pile. Advantage is taken of any channels that present themselves on the ground to assist in drainage. The opening of the culverts is 12 inches.

As soon as the Concentrating Mill was put into operation, the leaching site was covered with slimes as an extra precaution in preventing seepage or loss of solution into the ground.

Two heaps are under construction, No. 1 already containing 1,800,000 tons of material averaging 0.92 percent copper, and No. 2 containing 935,000 tons averaging 0.72 percent copper.

The area covered by the No. 1 heap is approximately 1,800 feet by 750 feet, the depth of ore being from 6 to 32 feet depending on the contour of the ground.

The average analysis of the ore is

Cu%	SiO_2%	Al_2O_3%	Fe%	CaO%	S%
0.92	63.5	11.2	8.3	0.7	6.8

The ore as received averages about 0.2 percent acid soluble copper.

The portion of the heap set apart for immediate leaching averages from 10 feet to 25 feet in depth, is the full width of the heap (750 feet) and contains approximately 200,000 tons of ore. Solutions percolating through the ore gravitate to the front of the heap (750 feet) and join the main drain which traverses the length of the heap, about 1,600 feet, terminating in a storage reservoir. From here these are pumped to the Cementation Plant.

Caliche forms the bottom of the drain and reservoir and apparently there is little loss of solution from seepage.

Leaching Operations

When contemplating large scale operations certain assumptions were made which were partly based on previous experience, amongst which were.

1. An average delivery daily of 300,000 gallons of mine water for leaching purposes.

2. Period of extraction. Six years to make a total recovery of 70 percent, divided as follows: First year, 20 percent; second year, 12 percent; third year, 10 percent, fourth year, 10 percent; fifth year, 9 percent; sixth year, 9 percent.

3. Average daily soakage and evaporation, 50,000 gallons. (Soakage is the amount of water taken up by the ore).

Leaching operations were commenced on September 12, 1924. During the first 12 months period, a total of 54,238,500 gallons of mixed water had been used for leaching, while the amount recovered from the heap and sent to the Cementation Plant was 41,084,750 gallons, showing a difference due to evaporation, soakage, and loss, of 13,153,750 gallons, equal to 36,037 gallons per day, or 24¼ percent of the total water to the heap.

All solutions are measured and sampled for three shifts during the 24 hours, both to and from the heap.

After deducting the copper sent to the heap in leaching solutions from that received from leaching operations, an extraction of 25.16 percent of the copper contained in the irrigated portion of the heap has been shown for the first year's operations. Of this amount 21.07 percent had been shipped to the smelter and accounted for, the remainder being in process. During the second year period of leaching the anticipated 12 percent extraction has been obtained in nine months.

One man only is employed to operate the heap.

Cementation Plant

This plant consists of six redwood tanks, 24 feet in diameter with 10-ft. stave, each containing a false bottom for supporting the iron. Underneath the false bottom is an acid-proof stirring arm worked from a shaft in the center of the tank, and which is suspended from the top of the tank. This is used for agitating the solution when necessary, and for moving the deposited copper to the central discharge on the bottom of the tank. The solution is introduced alongside the agitator shaft and delivered under the false bottom, then flows up through the iron and discharges over a peripheral launder into the next tank in series.

Each tank is connected to the next tank in parallel by a launder so that any tank may be cut out for separate cleaning or for adjusting the iron.

A gantry crane is used for unloading the iron from railroad cars and for filling the tanks.

After the solution passes from the last tank it flows to a sump from which the required amount is returned to the heap for leaching, the remainder passing on to a series of 3-ft. x 3-ft. launders built in duplicate, where most of the remaining copper is extracted preparatory to going to waste.

Large scrap of all descriptions is used in the tanks, and tin clippings from can factories are used in the launder plant.

The cement copper which is removed from the plant passes to an acid-proof classifier where the coarse copper is removed and deposited on drying floors, the fine or suspended copper passing to a thickening tank 24 feet in diameter, equipped with an acid-proof diaphragm pump which removes the thickened cement copper to drying floors, the clear overflow being pumped back into the cementation tank circuit.

When sufficiently dry the copper product is shovelled into mine cars and loaded into railroad cars for shipment to the Copper Queen Reduction Works at Douglas.

The plant is making an extraction of from 93 to 99 percent of the copper, the average content of the head solution for the first 12 months being:

	Ferrous Iron %	Ferric Iron %	Total Iron %
Cu. % .366	.2028	.2057	.4086

The grade of shipping copper averages about 70 percent.

Seven men operate the plant during the 24 hours.

Costs

The total cost per pound of producing the copper for the first 12 months period, including deferred expenses to the leaching heap and amortization of the plant has been:

Leaching	$0.0112
Cementation	0.0434
Total cost per pound	0.0546 f. o. b. Cementation Plant

Conclusions

From observation there is little loss of solutions by seepage into the ground on the site selected.

Percolation of solutions is good, showing little disintegration of the rocks in the heap, or plugging up due to the deposition of basic salts.

Results so far obtained confirm the fact that original estimates have been conservative, 37.28 percent of the copper from the leached portion having been extracted in 21 months of operation compared with the assumption of 32 percent in two years.

FLOW OF GAS THROUGH SOLIDS

THE pressure drop occurring when known quantities of gas flow through masses of screened ore has been measured and found to depend upon screen-size, volume percentage of voids between particles, temperature, pressure, and rate of gas flow. The purpose of an investigation being conducted by the Bureau of Mines has been to permit a calculation of the velocity of the ascending gas at any position inside the blast furnace. The stock descent is irregular across any horizontal section of the furnace, owing to localized combustion at the nose of the tuyeres. This investigation should lead to possible improvements in furnace design.

COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

NEWELL G. ALFORD, Editor

Practical Operating Problems of the Coal Mining Industry

OCCURRENCE OF FIRE DAMP IN BITUMINOUS COAL MINES*

Methods Used And Some Of The Results Obtained By The Consolidation Coal Company In Certain Of Its Mines In The Appalachian Field In Eliminating Fire Damp As A Hazard In Mining Bituminous Coal

By FRANK HAAS†

MANY articles have appeared in the transactions of the Institute on fire damp and little is left unsaid in regard to its physical properties, but practically nothing has been written in regard to its occurrence or fluctuation in quantity in an ordinary mine. The when, where and how much of gas is more properly the subject of this paper and it will present the methods used and some of the results obtained by the Consolidation Coal Co. in certain of its mines in the Appalachian field.

After the Monongah explosion, which occurred in 1907 with the loss of 361 lives, the operating organization of the company was instructed to devise a method by which such catastrophes could be prevented. While the cause of this particular explosion was attributed to coal dust the suspicion remained among those who were acquainted with the mines that fire damp had some part and was probably the initial cause, although there was no doubt that coal dust was the propagating and destructive agent.

The investigation was begun by a review of the literature on the subject, supplemented by inspections of mines where similar conditions prevailed and, finally, by a visit to the principal coal fields of Europe, all with the view of establishing some system by which gas could be more easily detected and controlled. The results of this particular study were disappointing. It was found that there was no method in practice other than the time-honored fire boss with his safety lamp, with some variations in the rules and regulations governing his inspections and reports.

DUTIES OF THE FIRE BOSS

Pending the development of a better method it was decided to standardize and perfect the duties of the fire boss and the reports based on his observations. Those who were then in service were closely examined, various lamps were experimented with and the lamps and individuals tested under known conditions. Without recounting the many conflicting results that were encountered the conclusion was that a fire boss could tell whether gas was present but his estimate of quantity was not even an approximation. It was plain that while the services of fire bosses were indispensible there was need of additional information by which the quantity of gas could be estimated with some precision in order to determine its variation from time to time.

CHEMICAL PROCESS FOR DETERMINATION OF METHANE

After considering all methods known at that time a chemical process was adopted. The principles involved in the process are that in an enclosed receptacle, in the presence of excess air, methane will be completely burned by means of a hot platinum wire to carbon dioxide and water, and barium hydrate will absorb completely carbon dioxide in a definite relation.

The samples of mine air are taken by water displacement in copper cylinders 12 inches in length by 4 inches in diameter with conical ends and a stop cock at each end. In taking the samples the can, which is full of water, is held at the point where the air is to be tested and both stop cocks are opened. When the water has been completely drained the stop cocks are closed and the can taken to the laboratory. In the laboratory a definite volume (350 c. c.) is transferred to an Erlenmeyer flask. When the flask is filled with mine air a two-holed stopper, with the holes filled by glass plugs, is fitted into the neck of the flask. Ten c. c. of barium hydrate solution, of known strength, colored with phenolphthalein, is introduced into the flask by removal of one of the glass plugs and the insertion of a pipette. Shaking the flask periodically for 10 minutes the excess barium hydrate is titrated with a

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† Consulting Engineer, The Consolidation Coal Co.

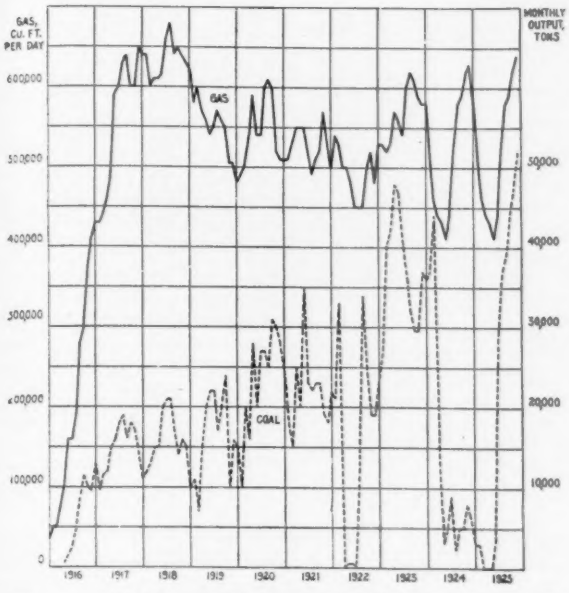


Fig. 1.—Relation Of Coal Mined And Volume Of Gas On A Mine In Pittsburgh Seam, Fairmont Region, W. Va.

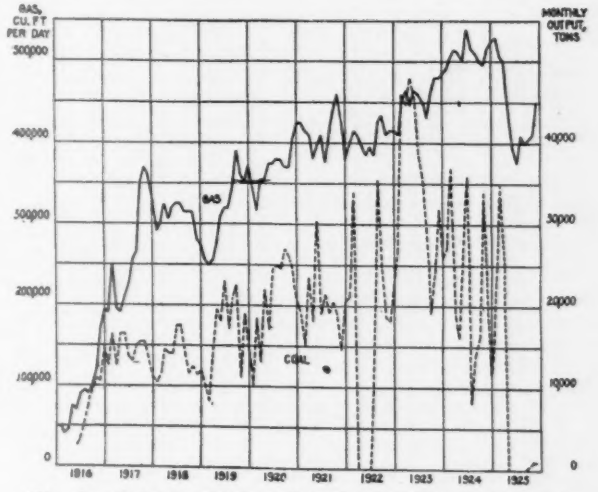


Fig. 2.—Relation Of Coal Mined And Volume Of Gas In A Mine Adjoining That Of Fig. 1. (Same Seam)

standard solution of oxalic acid. The result is a factor of the carbon dioxide in the sample.

A second flask of the same size is filled from the same sample. The stopper closing this flask is fitted with two copper wires with platinum terminals and these are connected with a small platinum wire (30 gage). A current of about 5½ amp. heats the wire to a bright red which causes the methane to burn to carbon dioxide and water. To prevent trouble due to expansion the flask stands under water during the combustion. Combustion is complete in about 10 minutes. This sample is now treated with barium hydrate (see preceding paragraph; treatment same as for first sample) and the excess titrated with oxalic acid. The result of this test is a factor of the sum of the carbon dioxide originally in the mine air sample plus that due to the methane present. The difference is the factor representing the methane. The solutions are made up so that 1 c. c. is equivalent to 0.1 percent of carbon dioxide or methane. The oxalic acid solution is very stable. The barium hydrate solution is standardized each day.

Selection of Gas Inspectors

To carry out the work certain individuals are selected who have a general knowledge of coal mining. After they are thoroughly drilled in the principles and practice of ventilation they are given a course in the laboratory. They are then known as gas inspectors and are given certain mines or group of mines for active duty. These inspectors are frequently interchanged, partly as a check on the work, but more particularly to have the entire force familiar with all the mines. These gas inspectors are also first-aid training men, thoroughly familiar with, and capable of working with helmets and are subject to first call in case of explosion, mine fire or other accident.

The frequency of taking samples is limited to the working force available. After the first survey, mines which showed only traces of gas were sampled monthly, others containing perceptible quantities were sampled weekly and those which showed the greatest quantities of gas were sampled daily.

The gas inspector on starting out on his daily routine carries an anemometer, a hygrometer and sufficient sample cans for the day's work. Eight cans are about all he can conveniently handle. His station for measuring velocity is constant for a long period and is of known cross-section. He takes 1-minute readings with his anemometer while moving uniformly across the section. A sample of mine air is also taken at this point, which is usually the end of a split. No difficulty is encountered in getting an average sample as it appears that the gas is thoroughly mixed with the air by the time the air current reaches the end of the split. There are, of course, frequent occasions for taking special samples such as determining the elevation of the explosive gas in the gobs or at intervals within a split, in fact endless combinations suggest themselves but are limited to the time available after the routine work is done.

Utility of Frequent Methane Determinations

The object of frequent determinations of methane is primarily to determine how much gas is evolved and to establish the relative volumes in the various sections with the view of supplying a sufficient total amount of air and distributing it to the various splits in a more logical manner. Mines having a small amount of gas do not need such close supervision but there are some coal mines where the production of coal is actually limited by the ventilating capacity, and it is in such cases that a most careful watch must be kept on this dangerous element with its erratic and apparently inscrutable tendencies. There was some hope that after daily analyses had extended over considerable time, an interpretation of the results might resolve itself into laws which govern its flow and possibly divulge some method by which the quantity could be predicted. After nearly 20 years of careful study in many mines the problem has not been solved, although certain tendencies have been established.

It would be a great assistance indeed, to a mining engineer, if he were able to predict the quantity of gas which would be encountered in opening up a new mine. It would further help him if he knew in mines already opened, when and under what circumstances additional gas would be encountered, or how to control the flow. A general statement can be made that the flow of gas follows the rate of development. Barometric pressure may have some influence on the flow of gas but in the presence of other and more powerful factors its effect is negligible. The truth is hidden in the confusion of many factors most of which are unknown and we will have to content ourselves to deal with this troublesome element when and where and in the quantities in which it is found. The engineer is therefore forced to provide for maximum quantities and there still remains the uncomfortable feeling that the best he can do may not be good enough.

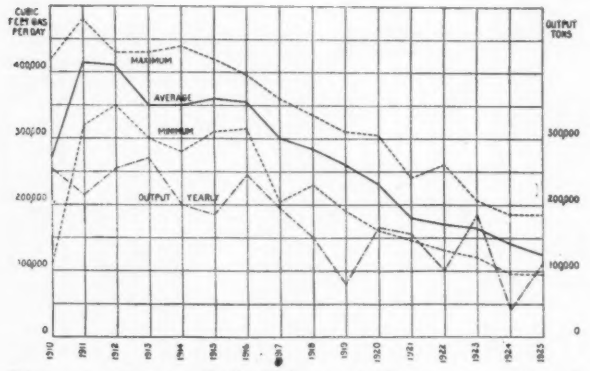


Figure 3—Average Daily Volume of Methane in a Mine in Pittsburgh Seam, Fairmont Region, W. Va.

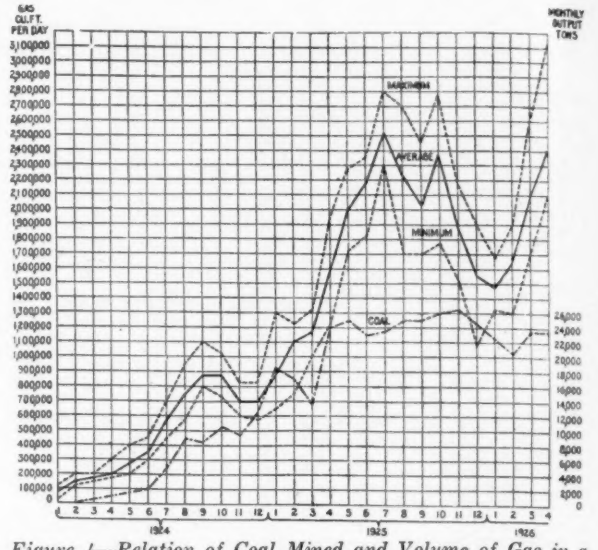


Figure 4—Relation of Coal Mined and Volume of Gas in a Mine in Pocahontas No. 4 Seam, Pocahontas Region, W. Va.

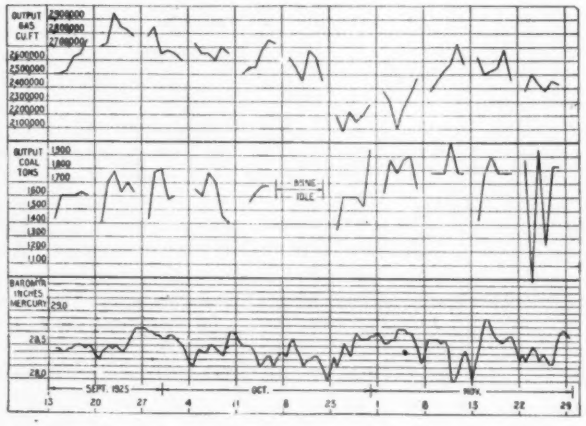


Figure 5—Daily Fluctuation of Gas with Tonnage and Barometer in a Mine in Pocahontas No. 4 Seam, Pocahontas Region, W. Va.

Accuracy of Analysis

So far only daily samples have been taken and it is probable that a continuous record would throw additional light on the subject, particularly as regards daily fluctuations which may occur during active or idle periods. In the use of this analytical method taking more than daily samples would be prohibitive in cost. In the accuracy of single determinations it is everything that could be desired. Frequent trials show that the same or different analysts can check within 0.005 percent. The analysis as reported shows also the carbon dioxide but since the sample is taken by water displacement no dependence is placed on it. It does indicate however if any abnormal amount of the gas is present. In the presence of hydrocarbons, other than methane, these are necessarily reported in their equivalent of methane.

Source of Gas

The source of gas in coal mines has not been satisfactorily explained. Gases of occlusion, adsorption or even the volatile matter in the coal itself are insufficient to explain the enormous and continuous volumes of gas that are exhausted from our mines. Several years ago in a paper before the West Virginia Coal Mining Institute the theory was advanced that the most of the hydrocarbon gases met with in our mines were natural gas and that coal seams were simply the reservoir and the path of flow from other strata. The suggestion was not generally accepted but our experience in the accumulation of quantitative results has strengthened our opinion in this.

The theory of coal formation assumes that all coal was originally in the form of peat, a compound of carbon, hydrogen and oxygen with some impurities. Like the peat of the present day it had a high percentage of volatile matter, of which a large part was water. In the transition to the various high-volatile and then to the low-volatile coals it has lost the volatile portion in various degrees. It is assumed that this change is the result of time, pressure and heat. Time and pressure are indisputable as primary causes, but heat must be defined with the degree of temperature. For instance, there was no such action as takes place in a laboratory in determining the volatile matter. It is more probable that no destructive distillation took place at all. A close study of the ultimate analyses of coals will show that the transition from high-volatile to low-volatile coal can take place by successive removals of combined water with no loss of carbon whatever. Certainly no large loss, if any, of volatile hydrocarbons was necessary to make the change. The physical characteristics were the result of time and pressure. Therefore gas as found in coal mines does not necessarily depend on coal as a source.

Graphic Presentation of Results

In the accompanying charts are given in graphic form some of the results obtained. Individual mines were selected to illustrate particularly some of the factors which were supposed to predominate in the rate of flow. The extraction of coal must necessarily be considered and the rate of coal output has in every case been plotted in parallel with the gas flow.

In Figure 1 is illustrated the gas flow (expressed in daily average by months for a period of 10 years) in a shaft mine 550 feet deep in the Pittsburgh seam of coal in the Fairmont region of West Virginia. The coal is of the bituminous type with about 38 percent volatile matter. The seam is practically flat and is free from any irregularity such as faults, or clay veins. The territory is practically virgin as the nearest opening into the seam was at least a mile away when the shaft was put down. The record has been continuous, samples taken daily (working days) since the shaft reached coal, which was in January, 1916. The peculiarity of this mine is that the maximum flow of gas was encountered within 3 years of its opening and settled down to a more or less uniform rate. In this case there is evidently no relation between the rate of output of coal and the flow of gas. Even in the case of no output for several months in 1925 the flow of gas was not more than appreciably affected.

In Figure 2 are shown similar results on an ad- (*Continued on page* 764)

ROOF CONTROL WITH UNDERGROUND CONVEYORS

This Article Is Presented As A Further Discussion Of The Subject Of Roof Control And Underground Conveyors Presented To The Convention Of Practical Coal Operating Officials At Cincinnati, Last May

By D. R. MORGAN*

WHILE the economic necessity for conveyors is general, the natural conditions are in many cases extremely adverse, and in many places it would be impossible to install conveyors on a commercial basis. But since the fact remains that conveyors have the effect of at least doubling the efficiency of labor, where they can be applied, the conveyor is one of the chief appliances to which we have to look in the future for increased production and decreased costs.

The introduction of conveyors in old mines is frequently attended with difficulties and in many cases has been disappointing. One fact to be considered is the weight of coal that can be loaded into the mine cars. Taking mine cars of the same capacity in both cases there will be a loss in weight as compared with hand loading.

If the haulage machinery is worked to full capacity under the old conditions, the substitution of a large number of conveyor filled cars means a decrease in tonnage. Of course, if arrangements could be made for hauling more cars in a given time, or hauling for a greater time, the loss could be reduced, but with an increased wage cost.

The loss in weight can be partially met by using cars of greater capacity for conveyor work and avoiding these from getting mixed up with the smaller cars that are used in the hand-filled places.

The question of roof support is the most vital of all as far as the successful working of a conveyor is concerned. I have known cases in which the introduction of conveyors has not made any noticeable difference to the roof either in the face or roads; in others the effect has been adverse.

A conveyor is a true longwall face. In the districts from which longwall has spread all over the world, the ordinary method of letting down the roof is to build a substantial packwall on either side of the roadway, a clear space or gob of from 15 to 20 feet being then left. According to the nature of the roof, this space is followed by a well-built gob wall, usually 6 to 9 feet in width, which is again followed by another open space, the gob walls and spaces alternating in this manner until the next roadway is reached.

The gob walls are carried forward in continuous lines from the time the road starts until it finishes being parallel with it.

There is one rather important difference between these longwall faces and a conveyor face; in the former the coal is worked off by means of a short face piece advancing either way along the face from the roadway. As soon as this passes either room side or intermediate gob wall, these are built up, so that the space between the face and the end of the pack is practically never more than just enough for a row of timber on either side of the mine car track along the face.

Two rows of timbers are generally maintained right through the face and the third row, back from the face, is maintained across the open spaces between the packs. It follows that as soon as the gob walls are built on either side of the gob there will be two rows of timber standing in it or four rows altogether from the face. As soon, however, as the packs are completed, the last row of timber is withdrawn; this may let the immediate roof over the coal fall between the packs and the last row of standing timber; in some places the roof is reluctant to do this, and it has been found beneficial to put in shots and blow it down.

A long, straight face, advancing at a steady and even rate, is followed by subsidence of the strata right up to the surface.

It is beyond human power to resist the roof pressure even in mines of moderate depth, and the experienced miner does not attempt to resist it.

This pressure has to be sustained somewhere and in practice it distributes itself. On the one hand, on the solid gob and the other on the solid coal, just beyond the face line, using the strata immediately overlying the coal in precisely the same way as the keystones of a bridge. This weight moves forward with the advance of the face and imposes a limit to the speed with which a longwall face can be worked.

If it were possible to work a face without any packs, or other support and, assuming that the roof is resting on the gob at the starting point, after the face has advanced a certain distance the roof would fall in a long solid beam, leaving behind it a cavity extending possibly from one end of the face to the other and varying in height. As to whether this cavity would extend to the coal face, or to a point on the gob side of it would depend on the nature of the strata immediately over the coal. In many cases these cavities would be strong enough to support themselves for some distance towards the gob, from the point where they are keyed in by the weight of the overlying strata and to fracture at a previously reduced line of weakness which has had time to develop.

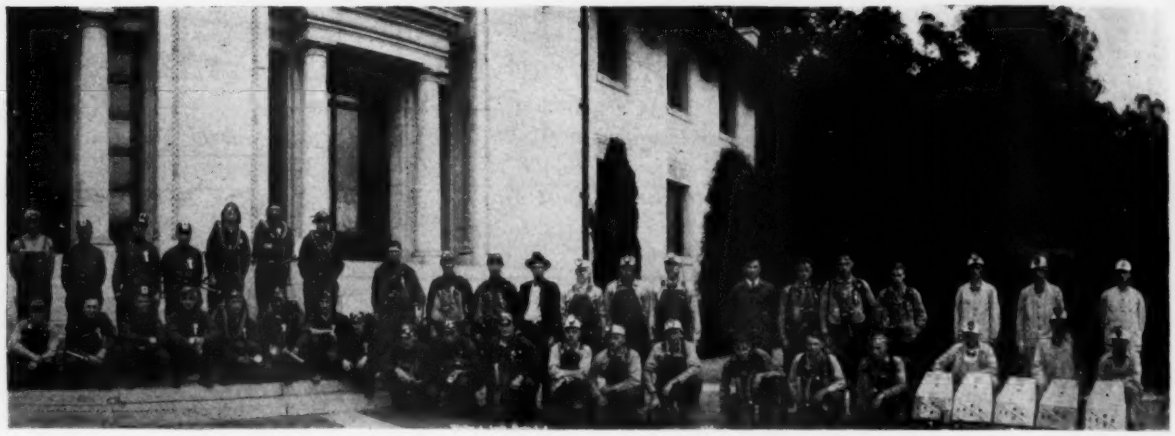
The object of the packs is to give temporary support to this mass of material and by compressing and yielding gradually under the increasing weight to let it down evenly and gently so that it is in position to take its share of the primary weight creeping over the gob as the face advances. The same object is achieved by allowing the roof to break across the gobs and free them up with broken debris to act as a cushion in the same way as the packs.

The practice of leaving timber standing in the gobs is contrary to all the rules of longwall work and in conveyor faces should be prohibited.

The writer has seen a composite prop used that consisted of a steel tube filled with wood to prevent buckling. These props are provided with renewable timber ends projecting about three inches at either end from the tube and these have been in daily use at the coal face for years without being sent out for repairs. This shows the enormous saving that can be effected by the systematic withdrawal of back timber and in addition to the benefits which accrue to the roof. The greater the amount of rubbish that can be stowed tight in the gob, the better are the chances with the roof. Loose rubbish sinks and leaves a space between it and the roof, which is the thing not wanted.

To enable conveyor work to proceed smoothly in the faces, it is necessary to take care in the aligning of timber. The timber must be set to leave a clear path for the conveyor on each side of the line of timber, securing at the same time a free path for the coal cutter along the face. A straight face is essential for proper longwall work, also for coal cutting and for a properly worked conveyor. Machine cutting is not essential to the working of a conveyor. The writer has seen conveyors work very successfully where the coal has been hard to cut. When the seam is of good thickness and works well by (*Continued on page* 752)

*Superintendent, Coalfield Coal Co., Coalfield, Morgan County, Tenn.



International Mine Rescue Contest Teams

INTERNATIONAL FIRST AID AND MINE RESCUE MEET

Mining Teams Show Skill In Tests Demonstrating Efficiency In Mine Disaster Relief—Pacific Coast Coal Company Of Washington Winner Of Combination First Aid And Mine Rescue Trophy —Safety Week In California

OUT-DISTANCING all other competitors for the handsome trophy and accompanying honors, the Pacific Coast Coal Co. team from Newcastle, Wash., was awarded the distinction of being the best all-round combination First Aid and Mine Rescue Team at the Fifth International First Aid and Mine Rescue Contest conducted by the U. S. Bureau of Mines of the Department of Commerce at San Francisco, August 30 to September 4.

In conjunction with this important event there was also held the Third Pacific Safety Conference and the Fourth Annual California Industrial First Aid Contest, sponsored by the City of San Francisco, the Societies of Safety Engineers of San Francisco and of Southern California. The week was observed in San Francisco as "Safety Week."

The International First Aid Contest had 46 team entrants, representing 13 states. The contest was run in relays, each relay working three problems. California Oil Co. teams made a clean sweep of the contest, capturing the first three places, with ratings as follows:

Shell Oil Co., Long Beach, 993; Standard Oil Co., El Segunda, 988; Standard Oil Co., Richmond, 986.

The teams winning the "State Championship" for the states in which there were a number of teams competing, were as follows:

Arizona—Phelps Dodge Corporation, Morenci, the team being composed entirely of Mexicans.

Washington—Pacific Coast Coal Co., Newcastle.

Illinois—Peabody Coal Co., sent by the Peabody Coal Co., made up entirely of members of Local No. 519, United Mine Workers.

The International Mine Rescue Contest was held on Saturday morning, September 4, at the Greek Theater of the University of California. Twelve teams representing eight states were entered in the contest. A structure simulating a mine drift about 200 feet in length, with two raises and two inclines, and with various obstructions such as low back, half-filled drift, etc., was erected on the stage of the theater. Visitors who had attended previous contests were unanimous in proclaiming it the best setting for a contest they had ever seen.

Coal Company Wins

The winners in the Mine Rescue Contest and their ratings were:

Madison Coal Corporation, Carterville, Ill., 995; Pacific Coast Coal Co., Newcastle, Wash., 970; Washington Union Coal Co., Tono, Wash., 970.

As the two last named teams were tied for second place, the first named won a toss and was placed second.

The highest score company with one team in the First Aid contest and another in the Mine Rescue contest was the Phelps Dodge Corporation with a First Aid team from Morenci and a Mine Rescue team from Bisbee.

The California First Aid contests, together with the International contests, were held in the San Francisco Civic Auditorium. In the California contests there were 27 competing teams in five divisions, as follows: Municipal, public service, manufacturing, mining, and petroleum. Mining was represented by three teams, two of which were from the Empire Mines Co., of Grass Valley, Calif., and the third from the American Potash and Chemical Co. Winners of the first three places in this contest were:

First, Standard Oil Co., El Segunda, Calif.; second, Union Oil Co., Oleum, Calif.; third, Empire Mines Co., Grass Valley, Calif.

Winners in the several divisions were as follows:

Municipal—Fresno Fire Department; Public Service—Pacific Gas and Electric Co., San Rafael, Calif.; Mining—Empire Mines Co., Grass Valley.

In addition to the contests, safety conferences were held at the San Francisco Civic Auditorium, the events drawing an attendance of more than a thousand persons. The addresses brought out much valuable and interesting discussion. The public safety session arranged by the Pacific Railway Club proved especially interesting.

The week's events were closed with a banquet at the Palace Hotel, Saturday evening, September 4, at which the contestants were guests. Dean F. H. Probert, of the College of Mines, University of California, presided and prizes were awarded to the winners of the various contests.

Credit for the success of the meetings is given W. A. Chowen, manager of the California Inspection Rating Bureau, and general chairman of "Safety Week," and Byron O. Pickard, who represented the Bureau of Mines.

Mine Operators Cooperate

Among those cooperating in the events were the Arizona Chapter of the American Mining Congress; California mineral, metal and petroleum producers, and Arizona and Nevada mine operators.

At the meeting of the mining section of the Pacific Safety Conference, pre-

University Of California, Berkeley, Calif., September 4, 1926

sided over by Mr. Pickard, E. D. Gardner, superintendent of the Bureau's Tucson station, spoke on the safe handling of explosives, and John T. Ryan, vice-president of the Mine Safety Appliances Co. of Pittsburgh, on modern types of gas masks and respirators.

R. E. Donovan, of the Standard Oil Co. of California, presided over the meeting of the petroleum section, at which addresses were made as follows:

H. C. Miller, engineer of the Bureau of Mines, on recent improvements in safety in the California petroleum industry.

B. F. Masten, of the Pacific Gasoline Co., Los Angeles, on safety in gasoline plants.

George F. Prussing, Union Oil Co., Los Angeles, on recent oil fires caused by lightning, illustrated.

G. H. Bowlus, General Petroleum Corporation, Los Angeles, on progress in lightning protection.

R. H. Ivory, of the Standard Oil Co. of California, presided over a session devoted to personnel of companies, at which Dr. R. A. Jewett, of the General Petroleum Corporation of Los Angeles, spoke on physical examination of employes.

Electrical Hazards

"With the introduction of electricity, mining hazards are increasing," said D. J. Parker, supervising engineer of the Bureau of Mines, at one of the conference sessions. "We are urging companies to take greater precautions against accidents. It is also important to educate workers to a realization of the value of safety devices."

The following were some of the problems worked out by the competing teams:

Man found unconscious on his back with arms extended above his head grasping a live electric wire with both hands. Remove from wire by a safe method and give artificial respiration by the Schaefer method. Each man of team, including captain, to give artificial respiration for one minute. Treat for burns of fingers and palms of both hands.

Man fell from first floor down elevator shaft, striking hoist. He was injured as follows: back broken 6 inches above waist line; right elbow bruised and skinned; slight cut on right heel, venous bleeding. Conscious but suffering from shock. Treat. When through treatment raise patient on splints upright to test anchor bandages.

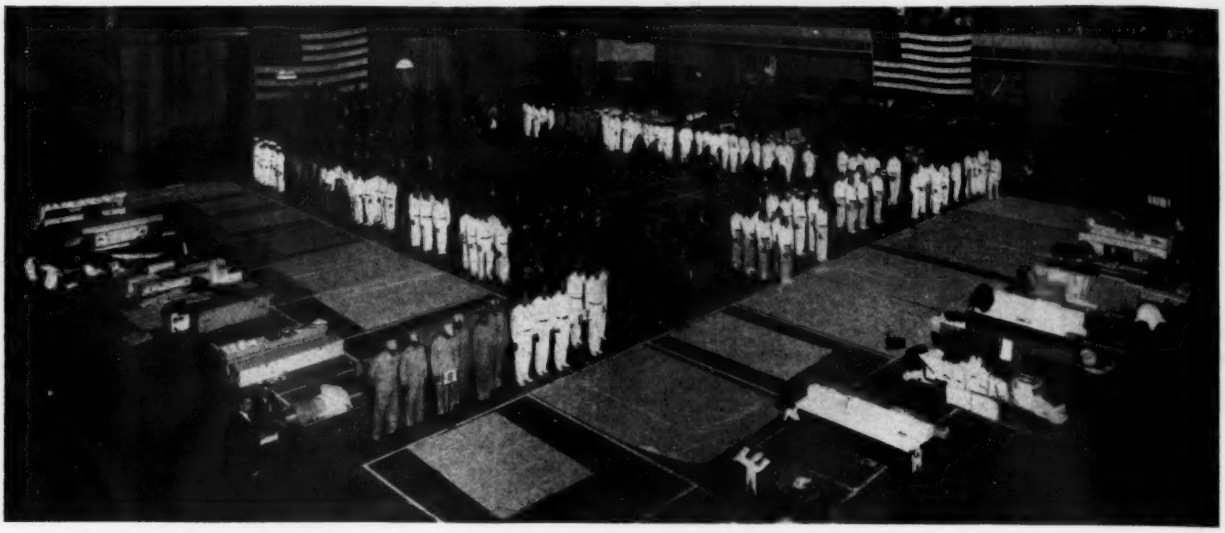
Auto skids at turn and strikes pole. Man is thrown through windshield, hits pole and falls into ditch. When found he is unconscious and has the following symptoms: blood flowing steadily from cuts on right ear and right cheek; blood spurting from deep cut in palm of left hand; decided deformity of bones of left leg 4 inches above ankle bone and bone is found to be protruding through skin on inner side of leg, with very little bleeding; the left arm is rigid, the elbow being about 2 inches from the side and the shoulder appears flater than the other one, a marked depression can be felt beneath the point of the shoulder. Treat. When second bandage of the leg splint is being tied arterial bleeding starts in the leg wound.

Yard man has load of light scrap metal dumped on him, being injured as follows: simple fracture of right collar bone; abrasion of point of left shoulder, capillary bleeding; dirt in right eye; cut 2 inches long on back of left hand, venous bleeding; slight cut on left knee; suffering from shock but fully conscious. Treat.

Rotary helper working in derrick without safety belt falls and strikes rotary table. Is found unconscious with the following symptoms: deep cut over left ear extending from temple backwards for 6 inches, blood spurting from wound; bleeding at nose and a watery serum is flowing from the ears; three fingers of the right hand are shortened and bones in back of the hand are protruding through skin, with slight bleeding; the left kneecap is discolored and has a decided crease across its middle. Prepare for transportation and carry 50 feet on an improvised stretcher.

Compound fracture of right kneecap, simple fracture of left thigh, simple fracture of ribs, little finger of right hand cut off 1 inch from end with blood spurting.

Team From Pacific Coast Coal Co., Newcastle, Wash., Awarded First Aid And Mine Rescue Trophy For Best Combination Team



International First Aid Contest In The Civic Auditorium, San Francisco

Treating a man who has been carried from a smoke-suffocating mine; lacerated wound on arm and cut on leg, with blood spurting.

Simple fracture of lower jaw; compound fracture of skull above left ear; cut on right ankle with arterial bleeding; shock and unconscious, but breathing nearly normal.

The following mine teams and their captains were entered in the meet:

FIRST AID CONTEST

Arizona—Nevada Consolidated Copper Co., Capt. W. W. Fertig, Ray; Phelps Dodge Corporation (3 teams), Capt. T. N. Jewell, Bisbee, Capt. G. C. Shook, Douglas, and Capt. Diego Parra, Morenci; United Verde Copper Co., Capt. T. C. Henson, Jerome.

California—American Potash & Chemical Co., Capt. Robert Underwood, Trona; Associated Oil Co. (2 teams), Capt. James Root, Associated, and Capt. J. T. Wilson, Wilmington; The Empire Mines (2 teams), Capt. Thomas Evely and Capt. John Warren, Grass Valley; Pacific Gasoline Co. (2 teams), Capt. L. J. Oliver and Capt. G. M. Liljenstein, Los Angeles; Pan American Petroleum Co., Capt. Carl Peduzzi, Wilmington; Shell Co. of California (2 teams), Capt. P. H. Hedgespath, Longbeach, and Capt. C. C. Howe, Wilmington; Standard Oil Co. of California (2 teams), Capt. Ralph M. Dyer, El Segunda, and Capt. A. D. Jones, Richmond; Union Oil Co. of California (2 teams), Capt. H. H. Hagen, Oleum, and Capt. E. J. Baird, Wilmington.

Colorado—Colorado Fuel & Iron Co. (2 teams), Mining Department, Capt. Charles Schwelka, Rouse & Lester, and Minnequa Steel Plant, Capt. A. O. Armstrong, Pueblo.

Illinois—Madison Coal Corporation, Capt. W. J. Williams, Carterville; Peabody Coal Co. (2 teams), Capt. John Lang, Springfield, and Local Union No. 517, United Mine Workers of America, Capt. Joe Rodden, Tovey; Southern Coal, Coke & Mining Co., Capt. D. T. Stuart, Belleville; United States Fuel Co., Capt. S. C. Shaffer, Danville.

Kentucky—Fordson Coal Co., Capt. Leonard Broughton, Kentenia.

Louisiana—Standard Oil Co. of Louisiana, Capt. M. C. Raiford, Baton Rouge.

Montana—Anaconda Copper Mining Co., Leonard Mine, Capt. C. M. Carroll, Butte.

Oklahoma—Golden Rod Mining & Smelting Corporation, Capt. H. H. Blanton, Cardin.

Utah—The Utah Copper Co., Capt. H. L. Garrity, Bingham Canyon.

Virginia—Clinchfield Coal Corporation, Capt. W. E. Wolfe, Dante.

Washington—Bellingham Coal Mines, Capt. George Cormie, Bellingham; Pacific Coast Coal Co., Capt. B. F. Smook, Newcastle; Washington Union Coal Co., Capt. Fred Pontin, Tono.

West Virginia—U. S. Coal & Coke Co., Capt. C. E. Parnell, Gary.

Wyoming—Union Pacific Coal Co., Mine No. 2, Capt. Lyman Fern, Cumberland.

MINE RESCUE CONTEST

Arizona—Nevada Consolidated Copper Co., Capt. Paul T. Whitehead, Ray; Phelps-Dodge Corporation, Capt. T. N. Jewell, Bisbee.

California—The Empire Mines, Capt. Thos. Evely, Grass Valley.

Illinois—Peabody Coal Co., Capt. John Land, Springfield; Southern Coal, Coke & Mining Co., Capt. D. T. Stuart, Belleville.

Montana—Anaconda Copper Mining Co., Leonard Mine, Capt. C. M. Carroll, Butte.

Utah—Tintic Standard Mining Co., Capt. Fred Johnson, Dividend.

Virginia—Clinchfield Coal Corporation, Capt. W. E. Wolfe, Dante.

Washington—Bellingham Coal Mines, Capt. George Cormie, Bellingham; Pacific Coast Coal Co., Capt. B. F. Smook, Newcastle; Washington Union Coal Co., Capt. Fred Pontin, Tono.

Wyoming—Union Pacific Coal Co., Mine No. 2, Capt. Lyman Fern, Cumberland.

Among the judges of the contests were C. A. Broake, of the Homestake Mining Co., Lead, S. C.; Rex Coates, of the Kemmerer, Wyo., Coal Co.; James Dalrymple, of the Hercules Powder Co., Denver; L. M. Kuhns, of the Gallup American Coal Co., Gamerco, N. M.; W. L. McCoy, of the Bertha Consumers Coal Co., Pittsburgh; George Nelms and J. T. Ryan, of the Mine Safety Appliance Co., Pittsburgh; F. H. Nesbit, of the Tri-State Zinc & Lead Ore Assn., Miami, Okla.; P. W. Racey, of the Tonopah, Nev., Belmont Development Co.; J. L. Shores, of the Alabama Power Co., Birmingham; Albert Tallon, of the Old Dominion Copper Co., Globe, Ariz.; D. H. Watkins, of the United Mine Workers, Albia, Iowa, and R. Donovan, of the Standard Oil Co., of California, San Francisco.

ROOF CONTROL WITH UNDERGROUND CONVEYORS

(*Continued from page* 749)

hand, there is much more to be gained by a proper direction of the face-line than by coal cutters.

Practical experience in the working of conveyors shows that faces of modern length are the most successful; also there is a limit to the speed at which a face can advance, and the writer is satisfied that moderation in everything connected with conveyor working is more likely to be successful than the straining of things to the utmost limit.

NEWS OF THE MINING FIELD

A Résumé Of The Activities Of The Mining Industry And Items Of Interest In The Field

Estimate of Minimum Tonnage of Colorado Ore Reserves

Charles W. Henderson, Engineer in Charge, Mineral Resources and Statistics, United States Bureau of Mines, Denver, Colo., and Statistician and Mineral Geographer, Mineral Resources, United States Geological Survey, in a paper delivered before the Colorado Scientific Society, gave the following interesting estimate of minimum tonnage of the ore reserves of the state of Colorado:

"There are no reliable data on the ore reserves of Colorado. It will take three to five years of active development work to determine the ore reserves. Colorado has unexplored and undeveloped areas in 170 old districts and in certain unprospected areas. Geology should be employed in the planning of development and prospecting.

"The extremes of opinion are: One man says we have 100,000,000 tons of low grade lead-zinc ores. Another asks —will this present increased activity last through 1926?

"I am prepared to estimate from what records I have that the present production of Colorado will continue for five years, as a minimum, and believe that the average yearly production will be greater than in 1925, thus assuring no abrupt falling off and disposing of the question as to whether the activity will continue through 1926.

"I am prepared to show proved ore and possible ore not fully proved of 10,000,000 tons. At our present rate of mining of 1,500,000 to 2,000,000 tons per year, we have approximately 5 years ahead of us assured.

"Estimates beyond 5 years depend entirely on the development work of 1926 and future years. At the end of 1926, a much clearer prophecy can be made.

"It is thought that much low grade ore can be opened in Colorado by proper development of both fissure veins and replacement ore bodies. At Gilman, Colo., 11 years of development work in the Blue limestone has proved large low grade lead-zinc ore bodies. The Blue and other limestones in Colorado deserve exploration. Already such work is being done at Rico and Kokomo.

"One fortunate factor can be credited to the lack of development during the last 10 years. Development can now be planned by the use of geology. Every foot of new development in Butte, Mont., for the last 10 years has been planned by geologists, with a saving of 50 percent in mining costs. Utah and Arizona, states which produced four times and five times, respectively, as much as Colorado in 1925, have made wide and successful use of geology.

"The Colorado Metal Mining Fund has made it possible for the next three years to make a start in applying expert geology to mining by a co-operative agreement with the U. S. Geological Survey, on a legal basis, under existing State and Congressional Acts."

Silver Output of World

The United States produced 5,073,000 ounces of silver in August, as compared with 4,673,000 in July, and 5,211,000 ounces in June. The total produced for eight months was 40,353,000 ounces. According to statistics released by the American Bureau of Metal Statistics.

Countries producing 89 percent of the world's silver in 1925 produced 18,331,000 fine ounces in August, according to American Bureau of Metal Statistics, compared with 18,325,000 ounces in July and 18,650,000 ounces in June. High for 1926 for these countries was 19,847,000 ounces, in March, and low 15,108,000, in January. Total for first eight months was 145,462,000 ounces, monthly average of 18,183,000 ounces.

IS HOARDING PASSING IN INDIA?

Imports of gold into India during the fiscal year ended March 31, 1926, amounted to 6,135,000 fine ounces—more than one-third of the world's total production during that period, according to Emmett A. Chapman of the Division of Regional Information of the Commerce Department. During the same period net imports of silver reached 93,363,000 ounces. While much of this metal was used in the arts, by banks and for speculative purposes, a very large part of it undoubtedly went into hiding or into ornaments in the back country sections for safekeeping against the rain-less day.

Chances of famine in India today are much more remote than formerly, transportation being well distributed, food exports controlled and relief societies existing to cope with emergencies. Nevertheless, hoarding continues, much as it existed a century ago, although probably on a much smaller scale. This practice of hoarding has been one of the greatest factors in hindering modern progress in India. It was originally founded on economic necessity. If the monsoon failed, either wholly or partially, disaster was certain to follow unless the native could draw on his hoarded gold or silver as the farmer in a more progressive country would draw upon or borrow from his bank.

During the past year an unusual amount of capital has been available, and the money market at present is easier than it has ever been before. The usual strain around crop-moving time is not anticipated this year. This abundance of capital suggests that more and more treasure is being brought out from hiding and deposited in banks or invested in securities. Not long ago it is stated that a wealthy Arab converted a hoard valued at $350,000 into Government of India securities. In all parts of India reports indicate that there is a steady conversion of hoarded rupees into investments.

This movement if continued is one that augurs well for India, as it will tend to bring the capital of the country into channels where it can be utilized for development and to liberate the country from its dependence upon foreign capital. It will undoubtedly be greatly stimulated when banking facilities are extended and when the poorer classes come to understand the advantage of depositing their surplus money where it will not only be safe but will also pay them interest.

COAST REFINERY ADVOCATED BY TALLY

Robert E. Tally, General Manager, United Verde Copper Co., in a recent issue of the Arizona Mining Journal, advocates the establishment of a Pacific Coast Refinery, saying:

"In Arizona is produced about one-half of the total copper, about 12

Robert E. Tally

percent of the gold and 9 percent of the silver of the United States. Of copper we produce about 23 percent of the world's production. There is not a pound of that copper refined or manufactured in the state nor in the southwest.

"We are now studying the economic possibilities for refining and manufacturing that copper in the West as against shipping it east. The policy of refining and manufacturing in the East and then sending a considerable portion of it back to the West and Middle West again is wrong, and whatever the difficulties of refining and manufacturing in the West might be, I am optimistic enough to feel that they will be overcome.

"Los Angeles harbor, by its natural location in closest proximity as a Pacific port to the Arizona copper, is available as a logical location for the refining of copper and distribution to world markets, provided the transportation, both by rail to the port and from thence by both rail and ocean, were put and kept upon a proper basis of rates and service.

"While it is not easy to change the flow of a basic commodity in its route to market, still we find that the copper industry of the world depends quite largely upon water transportation and, for that reason, Arizona copper should be attracted through its nearest established port.

"Recent revision in the transportation rates on blister copper from Arizona smelters to Los Angeles harbor gives grounds for belief that a substantial movement of copper will be routed by way of that port and steamship lines through the Panama Canal, both of refined copper and fabricated products.

"It is reasonable to suppose that with an increased tonnage in that direction a further adjustment of the freight charges, accompanied by adequate transportation services, would encourage the industry.

"The freight economy of local refining is apparent from the fact that the European market, which normally should take 50 percent of American copper, would receive refined copper from Los Angeles at a saving of nearly $5 per net ton.

"A refinery should be so located as to economically perform a custom service for the copper industry, and this requirement is capable of being met by the relation of Los Angeles harbor to the present smelting districts of Arizona.

"Other factors, however, are, supply and cost of power, labor, and local markets.

"In the combination of these factors Los Angeles stands second to none of any locality in the West.

"It should be possible here to deposit a pound of electrolytic copper at fair comparative cost of power among existing American refining centers, with the probability of still lower relative power cost when the Colorado River energy is transmitted to Los Angeles.

"Southern California is the only industrial community in the West enjoying natural gas fuel and also possesses cheap fuel oil.

"The present and potential water supplies of Los Angeles in both volume and cost, compare favorably with any other western city.

"No better labor situation exists in the West, nor elsewhere, in relation to the copper industry than is available in the Southwest. It applies alike to common, skilled and semi-skilled labor.

"Southern California by its present importance, and trend, in population and industrial development, constitutes the largest local market for refined copper and fabricated products of copper and brass in the western United States. Its continued building developments and the demands for copper by its public utilities and electric transportation companies are important factors.

"In 1923 the copper market was upward of 45,000,000 pounds within southern California alone.

"California power companies have estimated that their demands for copper by the year 1933 will have exceeded those of 1923 by nearly 150 percent.

"Upon this estimate and the trend of the building industry it is believed that the Southern California market for copper a few years hence will be not less than 100,000,000 pounds per annum.

"Upon the present local market there is the basis for a fabricating industry, in support of a refining operation, that should prove profitable as against the existing sources of copper and brass manufactures. But it is obvious that a wide territory throughout the West would be served with such products.

"Within the 11 Western states is 70 percent of the country's undeveloped waterpower."

Manitoba's Copper Zinc Ore Deposits

According to Prof. R. C. Wallace, head of the Geological Department of the Manitoba University, systematic drilling has definitely ascertained that there are 16,000,000 tons of ore in the Flin Flon mines, averaging in value 1.68 percent copper; 3.49 percent zinc, 0.74 ounces gold per ton and 1.04 ounces silver per ton. World prices for copper has so far prevented the development of properties in this district, but it is said that the Mining Corporation of Canada, owner of the property, is convinced that it is possible to recover the zinc as well as the other minerals, and that development of the property will be begun at an early date.

Flotation Plant Near Kellogg, Idaho

The Federal Mining & Smelting Company, announces completion of foundations for a concentration mill of 250 tons daily capacity. Erection of the building has begun. The mill will take care of ore from the Page mine.

Comstock Mines Production

According to the Nevada State Tax Commission, Comstock Mines produced $552,866 in bullion during the second quarter of 1926.

Inspiration Leaching Plant Ready

The new $6,000,000 leaching plant of the Inspiration Consolidated Copper Co. at Inspiration is expected to be completed in September and will be ready for operation in early October.

Tonopah's New Mill

Tonopah Belmont Development Co. at Hamilton, Nev., has its new mill practically completed and will start operations soon. A 9,000-foot aerial tram from the Cornell No. 2 Haulage Tunnel will supply the mill with lead-silver ore. Water will be piped from springs near the old California mill.

Utah Apex Mill

The new $300,000 mill of the Utah Apex Co. is nearing completion. It is expected to be in operation early this fall. The plant will separate the zinc and copper from lead ores, thereby permitting the company to realize on these materials at the smelters.

Sulphur in Nevada

A new mill, having capacity of 30 tons per day, has been placed in commission by the Humboldt Sulphur Co. near Winnemucca, Nev. The company is the only one producing sulphur west of the Rocky Mountains.

Wage Increase in Coeur d'Alene

Operators in the Coeur d'Alene have advanced the wages of miners 25 cents per day because of the advance in the price of lead to $8.90 per hundred. Miners are now receiving $5.50 per day, and affects approximately 5,000 miners.

St. Joe Lead Buys New York Zinc Mines

The St. Joseph Lead Company has purchased the Edwards properties of the New York Zinc Co., Inc., consisting of the Brown, White and Brodie Mines in St. Lawrence County, N. Y. The New York Zinc Co. succeeded the Northern Ore Co. in 1923. T. I. Crane is president and F. B. Haley secretary and treasurer.

Lewisohn Buys Otisco Group

Adolph Lewisohn and associates have purchased from G. Anderson and P. H. Kenny, of Butte, Mont., the bond and lease on the Otisco group of claims, lying east of the properties of the Butte Copper & Zinc Co.

High Grade Copper Found in Rouyn

A deposit of what is believed to be high-grade copper ore has been found in the township of Boischatel in the Rouyn mining area, northwestern Quebec, according to a report from Assistant Trade Commissioner J. Bartlett Richards, Ottawa, Canada, to the Department of Commerce. A first diamond drill hole had penetrated a body of porphyry formation and indicated copper ore while a second hole at a different angle successfully penetrated a very rich deposit of important size. The new discovery is encouraging to neighboring properties, including the Boischatel Mines Limited, which hold large claims in the district.

SCHEDULE FOR TAX APPEAL BOARD

The Board of Tax Appeals has announced the schedule for the fall term. Membership of the Board has been divided into committees for hearings to be held October 4 and December 20. Announcement also has been made that a series of hearings outside Washington will be held in the weeks beginning October 4, October 11, November 15 and November 22. The following is a memorandum of the Board's plans:

Week of Oct. 4: Milliken, Murdock, Lansdon, Love, Littleton.

Week of Oct. 11: Trammell, Trussell, Morris, Phillips, Marquette.

Week of Oct. 18: Milliken, Murdock, Lansdon, Love, Sternhagen.

Week of Oct. 25: Littleton, Trussell, Morris, Phillips, Marquette.

Week of Nov. 1: Van Fossan, Trammell, Green, Arundell, Sternhagen.

Nov. 8: No hearings.

Week of Nov. 15: Love, Smith, Littleton, Morris, Sternhagen.

Week of Nov. 22: Murdock, Lansdon, Green, Arundell, Phillips.

Week of Nov. 29: Milliken, Van Fossan, Sternhagen, Arundell.

Week of Dec. 6: Lansdon, Littleton, Morris, Phillips.

Week of Dec. 13: Milliken, Murdock, Love, Smith, Arundell.

A series of hearings on the circuit will be arranged for the weeks of October 4 and October 11, and November 15 and November 22. Messrs. Van Fossan, Trammell, Smith, Green, Trussell and Marquette will be assigned to these hearings; the first three named members during October and the last three during November.

Zonia Property Purchased by Loring

W. J. Loring and associates have purchased the Zonia property, which consists of four patented claims in the Walnut Grove Mining District, near Prescott, Ariz. This increases Mr. Loring's holdings to approximately 100 claims.

Potash in Utah

The Armstrong interests of Los Angeles have put down a number of holes to determine the thickness and extent of the potash deposits encountered in the Crescent Eagle Oil Well, in which a total of 918 feet of potash salts were encountered. Geologists are of the opinion that large potash resources will be proved by the Armstrong Co.

Reserves of Copper Ore

In a recent announcement the Federal Trade Commission finds copper ore reserves in the United States held by 133 companies, with a total of 1,588,000,000 tons. Arizona is credited with 39 percent, Utah 25 percent, and Michigan 11 percent. It is estimated that with an annual tonnage of 45,000,000 tons of copper the supply will last 40 years.

Suit Against Arizona Companies

Phelps Dodge Corp. and the Calumet & Arizona Mining Co. are the defendants in a suit brought by the Carson Investment Co. charging infringement of patents and processes relating to the charging of smelting furnaces. Nov. 16, 1926, has been set as the date for hearing. The defendant companies in their reply charge that Carson obtained the patent illegally, that he was not the first inventor or user of such apparatus, and that the issues raised are not the same as were used against the American Smelting & Refining Co., from whom Carson obtained a judgment in the Court of Appeals. Suits have also been brought against the United Verde Mining Co. and the United Verde Extension Co. by attorneys for Carson which involve the same issues.

Arguments Opened in Federal Mining & Smelting Co. Case

The State Supreme Court at Dover, Dela., heard argument in a mining corporation case which affects mining and other so-called "wasting assets" corporations dealing in the oil wells, leases and patents. The case is that of H. Content & Co., of New York, against the Federal Mining & Smelting Co., of New York.

On January 6th directors of the Federal Company voted for the payment of all dividends in arrears on preferred stock, declared a dividend of $10 a share on the common and declared it the policy of the company, after paying dividends on preferred stock, to distribute as dividends on common one-half of the remaining net earnings, computed without any deduction for current depletion of ore bodies, and to reserve the other half of earnings for the acquisition of new properties and other corporate purposes.

Content & Co. seek to have the company permanently enjoined from paying the $10.00 dividend and from paying any further dividends on common until it shall have accumulated a reserve "equal to the sum by which the invested capital of the defendant has been impaired by the depletion of the ore bodies contained in the mining properties owned by it since its organization," and from paying

any dividends whatever on its common stock while such payment might seem to impair its invested capital.

Chancellor Wolcott issued a preliminary injunction restraining the company from doing the things the complainants seek to have permanently enjoined.

Minnesota Mining Tax

$23,495,373.76 is the amount of tax levied under the various laws relating to taxation on Minnesota ore during the year 1925. This sum does not include royalties derived by the state from state-owned plants. The state collected $2,316,431.15 from the occupation tax law, $18,570,829 ad valorem tax on mineral plants, etc., and $1,767,309 from gross earnings on iron ore shipped during the 1925 season. It is estimated that the royalty tax will amount to $840,813.81, although there are some applications pending before the Minnesota Tax Commission which may change these figures.

Low Rates on Virginia Iron

The Virginia Pig Iron Association has filed with the Interstate Commerce Commission a brief in support of its plea for a rate of $3.96 to New York as against the present rate of $5.45. They argue that higher rates on iron from Virginia furnaces to New York and Pennsylvania than are charged on Pennsylvania iron have cut the sale of Virginia iron 90 percent. The railroads claim that it is imported iron rather than domestic competition that is injuring the Virginia product.

Validity of Contract

Frank D. Williams is the complainant in a suit instituted at Minneapolis, Minn., to determine "once and for all whether a written and signed coal contract is anything more than a scrap of paper, to be broken or violated whenever an outside concern can induce one of the parties to do so." The defendant in the case is the Great Lakes Coal and Dock Co. of St. Paul. Mr. Williams is suing this company for $5,000, which he alleges is the amount of damages which his concern suffered when the defendant company induced the Emporium Department Store to break a contract which had been in effect for 15 months and still had 9 months to run. The Great Lakes Coal and Dock Co. made an offer to the store to deliver coal of a kind and quality identical with that which the Williams Co. would have delivered, but at a price of 90 cents less per ton.

BITUMINOUS COAL CONFERENCE

The Conference on Bituminous Coal, to be held at the Carnegie Institute of Technology in Pittsburgh, has been definitely scheduled for November 15 to November 19, 1926.

The purpose of the meeting, according to Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, is to bring together the men of all countries who have done notable work in the study of more scientific and rational utilization of soft coal. Listed for discussion are such questions as the manufacture of substitutes for gasoline from coal; the complete gasification of coal; high temperature and low temperature carbonization; by-products; smokeless fuel; pulverized coal; hydro-electric power versus steam power, etc. In other words, the announcement points out, the purpose is to discover how soft coal can be made more valuable.

As a result of a visit to Europe this past summer by Dr. Baker, it is announced, several distinguished scientists and fuel technologists in Europe have accepted his invitations to attend the congress. German representatives will include Privy Councilor Prof. Franz Fischer, Director of the Institute for Coal Research at Mulheim-Ruhr, and Dr. Friedrich Bergius, of Heidelberg. England will be represented by Dr. C. H. Lander, Director of Fuel Research of the Department of Scientific and Industrial Research; Dr. R. Lessing, prominent fuel technologist, and Geoffrey Gill, engineer and specialist in the manufacture of gas. From France will come General Georges Patart, who was in charge of the manufacture of explosives during the war and who is the inventor of a process for making methyl alcohol from coal. In addition there will be a representative from the Office National des Combustibles Liquides. Besides these, a number of European specialists who have done work in the development of certain processes are expected to attend.

American engineers, scientists, and fuel technologists who have been doing important research work in the chemistry of coal and other problems will have a large share in the program.

Among the members of the Advisory Board assisting in the development of the conference plans are Andrew W. Mellon, Secretary of the United States Treasury; Johns Hays Hammond, engineer and inventor; Otto H. Kahn, banker; Charles M. Schwab, steel manufacturer; Samuel Insull, public utility leader; E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., and Dr. Frank B. Jewett, vice-president of the American Telephone and Telegraph Co. and director of research of the Bell Telephone Research Laboratories.

Lake Cargo Rate Hearings

Commissioner Hall and Assistant Chief Examiner Gerry, will preside at the postponed hearing before the Interstate Commerce Commission, in the Lake Cargo Coal rate cases. The date had been previously tentatively scheduled for September 14, but are now definitely called for October 25. Ohio and Pennsylvania lake cargo coal shippers protested the decision of the Commission in which it declined to disturb existing adjustments of lake cargo rates. Other operators are contending that labor conditions, and not freight rates are responsible for the decline in the use of coal from northern producing territory.

Denies Application Coal Rates

The Interstate Commerce Commission has denied the application of the Illinois Central and the Yazoo and Mississippi Valley R. R. companies who asked authority to establish rates on bituminous coals from mines on the Illinois Central at Brilliant, Ala., from Group 2 mines in Alabama on the St. Louis-San Francisco, and from mines on the Illinois Central in Illinois and Kentucky in groups 1, 2 and 3 to reserve Louisiana without observing the fourth section of the Act.

Winnifrede Elects New President

The Winnifrede Coal Co. has announced the election of Leigh Willard as President and General Manager. All of the properties owned by this company are placed under his direction.

West Virginia Mines Busy

More than 200 mines in northern West Virginia are now in active production. Increased activity is noted through the advertisements of coal companies for more mine workers, together with the preparations of large companies to place their plants in condition for largely increased output. Northern West Virginia mining fields output approximately 700,000 tons per week. Southern West Virginia mines, especially the Mobattle, continue to benefit by the heavy call for exports.

OHIO GOVERNOR ISSUES PROCLAMATION

The Governor of Ohio, Mr. Donahey, is lending his influence to that of the operators in trying to rehabilitate the mining industry of Ohio. It is felt that the effect of the Governor's proclamation urging Ohioans to get back of a state-wide movement to use Ohio coal will be far-reaching. In issuing his proclamation the Governor said:

"Ohio's coal industry, which only a few years ago stood second in importance among the industries of our state, has been gradually forced into a vastly inferior position. Never before in the history of Ohio has a great business suffered so rapid a decline. Unless checked at once the fast approaching, ultimate result will be complete paralyzation of our entire mining system.

Conditions Beggar Description

"The true conditions surrounding our coal fields beggar description. Both miners and operators are continuing to suffer, as they have for the last few years, from lack of orders, and the inactivity necessarily attendant thereto; the only difference lies in the alarmingly increasing number of sufferers and the intensity of their poverty.

"So serious has the situation become that nothing but universal patriotic purchase of Ohio coal by Ohio coal users in the immediate future or extensive alms—which are neither desired nor asked—can possibly prevent virtual starvation of the unfortunate miners and their families during the cold months which confront us.

"For the third consecutive year the governor is officially calling the attention of his fellow citizens to their manifest duty to buy Ohio coal; he no longer merely urges them to use it—he is now pleading with them to do so.

"Ohio consumes approximately 70,000,000 tons of coal annually and is now capable of producing less than 55,000,000 tons in the same period of time with the mines running at full blast, yet, due mainly to lack of cooperation of consumers with producers our output which in 1923 was 40,726,215 tons in 1924 decreased to a total of 30,077,290 tons, in 1925 further decreased to 27,348,987 tons, while at the present rate less than 21,000,000 tons will be produced for the calendar year 1926.

"There are 55,000 miners in this state, but fewer than one-third of them are employed at their trade and many of those only for part time. This failure to create wealth affects every taxpayer. In addition to the economic loss resulting from idleness, $150,000,000 is reliably estimated to have left Ohio in 1925 through buying coal from other states. Every ton of Ohio coal burned means work for our miners and increased prosperity to our state.

"There is no better coal than that with which Ohio's hills are lined; it is unexcelled either for domestic use or for general industrial purposes. Every state institution, at the direction of the governor, burns Ohio coal. The results have been gratifying and if given an opportunity it will prove equally satisfactory in the home, in the factory, and elsewhere.

"How to burn bituminous coal properly in order to obtain the best results is no longer a question. There have been developed recently furnaces and appliances, comparatively inexpensive, which enable one to use soft coal economically and smokelessly. Apparatus of this type, the cost of which will be paid for in a short time through the fuel saved, should be secured by the consumer at the earliest opportunity.

"The general prosperity of our great commonwealth can not be permanent until it includes the miner, and it will not embrace him until Ohio coal industry is revived and restored to the high plane which it once rightly occupied."

German Coal Economist Studying American Coal Industry

Dr. Ernest W. Jungst, economics secretary of the Berbaugh-Verein of the Essen-Ruhr mining district of Germany, has been spending several weeks in this country studying the American Coal Industry.

Dr. Jungst is particularly interested in the export situation and labor relations. The selling of coal in Germany is quite unlike the method employed here. The output of all mines is in the hands of a selling syndicate, the syndicate allotting available orders to all mines in the district on the basis of capacity rating. Price fixing is encouraged by German law. Price is established by a so-called coal parliament, in which labor, operators and the consumers are equally represented. The advantages claimed for this method by Dr. Jungst is that the public is protected against excessive prices and the operators against operation at a loss.

Consolidation Men Confer

More than 100 officers and employes of the Consolidation Coal Co. attended a two-day conference of all departments held at Fairmont, W. Va., recently. The meetings were held in the ballroom of the Fairmont Hotel. G. J. Anderson, Executive Vice-President of the company, made a talk on "Some Factors in Organization." Other addresses were made by F. W. Wilshire and F. R. Lyons.

Consolidation Plans Large Expenditures

It is understood that the Consolidation Coal Co. has begun work on a program of construction and expansion wherein they will spend approximately $2,500,000. A large proportion will be spent in improving the homes of employes. Every house will be repaired, new sewer lines and improved drainage conditions installed, concrete walks, etc., will be constructed.

Farrington Joins Peabody

Frank Farrington, President of the Illinois Division of the United Mine Workers, and an active worker in miners union for more than 20 years, has accepted an executive position with the Peabody Coal Company of Chicago, where his duties will be in the nature of labor counsel.

Wage Scale For Ohio Workers

The newly organized Ohio Coal Operators Association, Inc., it is understood, will offer miners in this district a day rate of $5. It is expected that under this rate that many of the Ohio mines now closed will reopen.

N. C. A. Safety Committee

The National Coal Association has announced the appointment of 11 men, headed by Phil H. Penna, Secretary of the Indiana Bituminous Coal Operators Association, as a safety committee for the year 1926-27. Other members of the committee are: E. B. Bartholmew, American Smelting and Refining Co.; Thomas E. Frear, Inland Collieries Co.; James Elwood Jones, Pocahontas Fuel Co.; Marshall J. H. Jones, Bertha Consumers Co.; W. A. Ellison, Mahan Ellison Coal Corp.; R. P. Maloney, Davis Coal & Coke Co.; D. H. Morton, Leevale Coal Co.; J. C. Nelms, Ohio and Pennsylvania Coal Co.; George F. Peter, Southern Coal & Coke Co.; J. W. Wetter, Madeira-Hill Coal Mng. Co.

Secretary New Coal Association

D. H. Pape, for two years associated with the National Coal Association, has left that organization to accept the secretaryship of the newly organized Monongahela County Coal Operators' Association.

QUARTERLY MEETING ARIZONA CHAPTER

The quarterly meeting of the Arizona Chapter of the A. M. C. was held at Bisbee, Ariz., Sept. 13 and 14. The visiting men being the guests of the Bisbee Section, Phelps Dodge Corp., the Calumet & Arizona and the Shattuck-Denn Companies. An exceptionally fine program was prepared. The principal papers there presented appearing in full in the September and October issues of the Mining Congress Journal. The following is the list of the papers presented:

"Water Treatment and Underground Leaching at the Bisbee Mines of the Calumet & Arizona Mining Co." By H. M. Lavender, Chief Engineer, Calumet & Arizona Mining Co.

"Deep Mine Pumping at Calumet & Arizona Mining Co." By E. F. Irving, Chief Master Mechanic.

"Sampling and Estimating of the West Ore Body of Sacramento Hill, Copper Queen Branch, Phelps Dodge Corp." By H. M. Ziesemer, Chief Engineer, Sacramento Hill Operations.

"Heap Leaching Sacramento Hill Low Grade Ore." By A. W. Hudson, Leaching Engineer, Copper Queen Branch, Phelps Dodge Corp.

"Flotation of Lead Carbonate Ores of the Warren Mining District, Bisbee, Ariz." By I. H. Stanley, Mill Superintendent, Shattuck-Denn Mining Corp.

In addition to the technical and business sessions trips of interest were provided the visitors.

Coal Association Organized

A charter has been granted to the Monongalia County Coal Operators Association and it will resume activities with a view to the stabilization of the industry in northern West Virginia. The incorporators are C. A. Goodwin, General Counsel for the Brady-Warner Colleries Co.; F. C. Shriver, President, Shriver Coal Co.; S. D. Brady, of Fairmont; W. E. Watson, Fairmont and Cleveland Coal Co.; E. M. Showalter, Continental Coal Co. The following have been elected as officers of the organization: John H. Jones, Bertha Consumers Co., President; R. N. Davis, of the Gilbert-Davis Interests of Morgantown, Vice-President; and F. C. Shriver, Treasurer.

Rocky Mountain Coal Institute Meets

Papers presented to the meeting of the Rocky Mountain Coal Mining Institute, at Glenwood Springs, Colo., on Sept. 9, included many phases of mining, with particular reference to problems of operation, such as mine timbering, mechanical loading, mining methods, coal preparation, and cutting and shearing of coal. F. J. Baker, superintendent of the Primero Mine of the Colorado Fuel and Iron Company, presented a paper on the work they are doing in preserving their timbers. Other papers included "Experiments at Dawson in Increasing Production per Man By Changing Mining Methods," "Late Developments in Mechanical Loading." Discussion as to whether shearing is advantageous in certain kinds of coal, advantages of undercutting and overcutting as regards production of slack, vocational training for mine workers, and an interesting report by the Safety Committee, concluded the session.

Conference of Safety Council

The Seventh Annual Conference of the Lake Superior Section of the National Safety Council, which was held at Ironwood, Mich., recently is said to have been the most successful in the history of the section, both from the standpoint of attendance and the quality of the papers presented.

Industrial Association Meeting

The Eighteenth Semi-Annual Conference of the Executive, Advisory and Public Policy Committees of the National Industrial Council, and the National Conference of Industrial Association Executives, will be held at the Waldorf-Astoria Hotel, New York City, October 4-5, 1926; among the papers to be presented is one by James A. Emery, General Counsel of the National Manufacturers' Association, on "National Issues and Problems Confronting Industry in the Next Session of Congress."

Meeting Lake Superior Mining Institute

The twenty-fifth annual meeting of the Lake Superior Mining Institute was held at Ironwood, Mich., and Milwaukee, Wis., Sept. 8-9. The following papers were presented:

"Early History of the Gogebic Range," by C. C. Taylor, Ironwood; "Research Work at Michigan College of Mines," by Dr. W. O. Hotchkiss, president Michigan College of Mines, Houghton; Paper by L. P. Barrett, Mining Geologist; "Reducing the Secondary Shooting by the Primary Blast, Ogden Mine," Cleveland-Cliffs Iron Co., Ishpeming; "Standard Maps Used by Pickands, Mather & Co. on the Gogebic Range," by H. W. Johnson, chief mining engineer, Gogebic Range; "Further Data on the Correlation of the Cuyuna Iron Bearing Member," by Carl Zapffe, general manager of Iron Ore Properties of Northern Pacific Railroad Co.; "Drifting at the Odgers and Tobin Mines," by E. J. Oswald, Crystal Falls; "Use of Explosives," by Dupont Powder Co.; "Fluorspar Mining and Its Uses," by Carl Fellman, general superintendent; Rosiclare Lead & Fluorspar Mining Co., Rosiclare, Ill.; "Evergreen Sintering Plant on the Cuyuna Range," by Robert Adams; "Tunneling," by A. Guthrie & Co., Inc., for the Great Northern Railroad; "Accident Prevention Practice in the Lake Superior District," by Gogebic Range Safety Engineers' Committee; "Metallurgical Operations for Iron Ores," by Prof. McGafferey, University of Wisconsin; "Development of the Volunteer Open Pit on the Cascade Range," "The James Mine Electrification," by W. G. Hanson; "Prescott Pump Development in the Lake Superior Country Now Used Extensively in the Oil Fields," by Curry S. Prescott; "Mining Methods on the Gogebic Range," by Montreal Mining Co. (Oglebay, Norton & Co.). Castile Mining Co. (Oglebay, Norton & Co.), Oliver Iron Mining Co., and Pickands, Mather & Co.; "New Surface Equipment on the Gogebic Range," by Montreal Mining Co. (Oglebay, Norton & Co.), Castile Mining Company (Oglebay, Norton & Co.), and Ironton Mine (The McKinney Steel Co.); "Deep Shaft Sinking at Eureka Mine," by Castile Mining Co.; "Deep Shaft Sinking at Geneva Mine," by Oliver Iron Mining Co.; "The Montreal Mining Co. Method of Making Up and Mixing Cargoes at the Docks at Ashland, Wis.," by H. D. McDonald, chief chemist."

The first day of the meeting was spent in visiting the west and east ends of the Gogebic Iron Range. A special train took the members of the Institute to Milwaukee, where they visited the plants of the Allis-Chalmers Co., Nordberg Mfg. Co., A. O. Smith Co., The Cutler-Hammer Co., Worden-Allen Co., and the Bucyrus Co.

The following were elected officers for the ensuing year: President, Charles H. Baxter, Loretto, Mich.; vice-presidents, George J. Eisele, Iron Mountain, Mich., and Harry Vivian, Calumet, Mich.; managers, Frank Smith, Crystal Falls, Mich.; H. I. Pearl, Crosby, Minn., and F. H. Cohoe, Hibbing, Minn.; treasurer, John E. Nelson, Negaunee, Mich., and secretary, A. J. Yungbluth, Ishpeming, Mich.

COAL MINERS RECEIVE CERTIFICATE OF HONOR FROM U. S. GOVERNMENT

The coal mine having the best record in the United States Bureau of Mines National Safety Competition for the bronze trophy "Sentinels of Safety" presented by The Explosives Engineer magazine, was the Upper Lehigh Colliery of the Hazel Brook Coal Co., Upper Lehigh, Pa.

Each employe of the colliery has received a certificate of honor signed by the director of the U. S. Bureau of Mines.

The picture shows D. W. Muir, superintendent of the mine, distributing the certificates to a carload of miners as they are coming off shift. He is shaking hands with the company's oldest miner, John Potschner, who is 58 years old, and has worked underground 45 years—practically all of this time in the same mine.

Institute Discusses Minerals

"Mineral Resources in Their Political Relations" was the basis of a round-table discussion presided over by C. K. Leith, of the University of Wisconsin, at the meeting of the Institute of Politics, held at Williamstown, Mass. Others participating in this discussion were H. Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers; C. F. MacDowell, of the Armour Fertilizer Works; F. R. Wadliegh, formerly editor, Coal; E. A. Holbrook, G. H. Ashley, F. G. Tyron, W. L. Heroy, J. W. Furness, Wilber Judson, W. H. Aldridge, Eugene McAuliffe, E. DeGolyer, F. Julius Fohs, A. C. Fieldner, Charles Camsell, S. A. Taylor, Harry Hotchkin, C. P. Perin, A. C. Lane, S. S. Wyer, G. R. Mansfield, R. D. Pike, S. C. Lind, H. F. Cleland, and others. The meetings were arranged for the last three days of each week from July 29 to August 21. At the first conference Mr. Leith outlined principal features of mineral geography. The second conference dealt with coal, and the third to fertilizer minerals. A very full report of these conferences is found in the September issue of Mining and Metallurgy.

Taylor on Trip Through Arizona

Samuel A. Taylor, President of the American Institute of Mining and Metallurgical Engineers, has been spending some time in Arizona visiting various mining camps. Mr. Taylor, who was formerly president of the American Mining Congress, attended the meeting of the Arizona Chapter of that organization at Bisbee and Douglas, Sept. 13 and 14. With Mr. Taylor were H. Foster Bain, Secretary of the Institute; E. P. Mathewson and Dean Butler, of the University of Arizona, and Charles F. Willis, Editor, the Arizona Mining Journal.

Copper Export Association

Copper officials have definitely refuted the recent report that the new Copper Export Association had been abandoned, or that the plans announced for this organization had been temporarily shelved. It is understood that most of the important Belgian Congo concerns have given their consent, and that so far as the American producers are concerned little remains to be accomplished aside from the consent of the Federal Trade Commission, whose decision has been temporarily delayed.

KENTUCKY RAISES INSURANCE RATES

Underground coal mining insurance under the Compensation Act has been raised from a basic rate of $4.57 on the $100 of mine payroll to a basic rate of $11.16, under authorization of the Kentucky Workmen's Compensation Board. The Secretary of the Board said that "practically all of the insurance companies in the Kentucky field are withdrawing because their losses have been so disastrous." According to the Aetna Insurance Co., "the condition of many mines in the state is not up to standard." Companies other than the Associated Companies, including all members of the National Council on Workmen's Compensation Insurance. will work on a new basic rate of $6.23. Coal operators have filed protests against the new rate and officials of operating companies have said that it will work a hardship on many mines and cause all to suffer. The companies contend that the new rates are necessary if mine owners are to receive protection at all.

Safety Day Contest

First honors in the West Virginia State Safety Day Contest, held at Huntington, went to the team from No. 8 mine of the Island Creek Coal Co., who were presented with a cup which is to be kept as a permanent souvenir of the victory. One hundred and twenty-two teams competed for the cup.

Safety Rules for Electrical Equipment

The standard code governing safety rules for installing and using electrical equipment in coal mines, prepared by the Standardization Division, the American Mining Congress, which has been before the Mining Standardization Correlating Committee of The American Engineering Standards Committee, through the joint sponsorship of the American Mining Congress and the United States Bureau of Mines, was voted upon at a recent meeting of the A. E. S. C., held in New York. This body has recommended the formal adoption of the recommendations made in this code and a national code upon this subject.

Oil-Bearing Formations of Southwestern Arkansas

The Department of the Interior, through the Geological Survey, with the advice and co-operation of George C. Branner, state geologist of Arkansas, has just completed a geologic investigation yielding results that will be of practical interest to all geologists engaged in the search for oil and gas fields in southern Arkansas and northern Louisiana. In these regions the finding of hidden structure favorable to the occurrence of oil and gas has been hampered by the scarcity of information as to the variations in thickness and character of the buried Cretaceous formations, and uncertainties arising from this cause have added greatly to the aggregate cost of wildcat exploration. This article presents a condensed description of the Cretaceous formations which reach the surface in southwestern Arkansas, north of Red river and east of the Oklahoma line. It thus affords a guide to the interpretation of the logs of exploratory wells drilled in areas in southern Arkansas and northern Louisiana where these formations are under cover, and hence where they may contain oil and gas in commercial quantities if local structural conditions are favorable.

The field work on which this article is based consisted of a study of the Upper Cretaceous outcrops in southwestern Arkansas, supplementing work previously done by H. D. Miser. The investigation was carried out by C. H. Dane, with the advice and under the general guidance of L. W. Stephenson and with the assistance of P. D. Torrey. Copies of this report may be obtained from the U. S. Geological Survey, Washington, D. C.

THE NATION'S VIEWPOINT

A Digest Of The Expressed Opinions Of Leaders In American Affairs

THAT Labor does not think of itself as a class but as a participant in a common national interest is the opinion of the *New York Times*, which has the following to say concerning the present labor situation:

"Foreign visitors in quest of the secret of American prosperity and other visitors with special interest in the American labor and Socialist movement frequently find themselves converging to the same point—the unparalleled well-being of the American workers. One group of English investigators reports that our national prosperity is due chiefly to high wages and resultant high purchasing power. Mr. Arthur Henderson came here last year in search of a militant labor movement and failed to find it. Our workers were too well off, he reported. Some day American labor may discover that it has paid too high a price for its automobiles and radios by the loss of class consciousness. It is a risk, one suspects, which the American workingman is prepared to take. At any rate, the doctrine of the 'class war,' never potent in this country, enjoys today purely archaeological interest. Labor does not think of itself as a class, but as a participant in a common national interest.

"It is not a case of being drugged by prosperity. In much less prosperous and much more troubled Europe labor has exhibited a decided trend away from the old battle cries. The outstanding event of the labor year was, of course, the British general strike. Whether we explain that remarkable exhibition of mass self-control in terms of the British temper or of the British labor temper, it comes down to the same thing. To say that the British strikers conducted themselves as they did because they were Englishmen is to abandon the whole case of the class war, which assumes that men are proletarians first and Englishmen afterward. The general strike has been prolonged in a coal strike over many weeks; nevertheless, there has been no suggestion of an irrepressible class war. British doggedness will account rather for the continuation of the coal strike which now gives signs of happily drawing to an end. The erstwhile fire-breathing 'Emperor' Cook is now preaching moderation and compromise. Recognition seems at last to have won its way among the strikers that they must bear part of the weight of a crippled industry, and that wages can not be maintained when profits disappear.

"Elsewhere in Europe the same sense of communal responsibility has manifested itself. German labor has repeatedly evinced its readiness to place the national interest above class interest amid the grave problems that have beset the fatherland. French Socialists permitted themselves the luxury of indulging in their pet formulas during the troubled period preceding the advent of M. Poincare, but in this respect they were not markedly different from the other parliamentary parties. The socialists are not represented in the present cabinet, but their opposition has been purely formal. There is every reason for believing that French Socialists and workers do not differ greatly from the rest of their countrymen about the desirability of averting financial disaster. That labor is in the same boat with all other classes has been too well demonstrated. The lesson ranges all the way from the United States, where the worker shares in the national prosperity, to Russia, where the worker has been compelled to share in the general impoverishment."

Wallace Press-Times

A New Era For American Labor

NEWS ITEM—*Wage earners in the United States today own more than $700,000,000 worth of stocks in the industries in which they are employed*

William Green, President American Federation of Labor, bolsters up Mr. Wilson's opinion when in his Labor Day address he points out Labor's contribution to the rise in living standards. The following comment on Mr. Green's address appears in the *Wall Street Journal:*

"Labor Day in this year of grace and prosperity brought forth from spokesmen for American unionism only utterances of fair import. President Green, of the Federation, called for recognition of the part played by handworkers in the achievements of mankind and the maintenance of living

Wallace Press-Times
Stealing Our Stuff

standards on an ever rising plane. He took full advantage, as might have been expected, of the growing vogue of the theory that high wages create prosperous industries, but was almost wholly free of the sometimes factitious defiance of the world which the late Mr. Gompers never failed to bring into his public addresses.

"Only indirectly did the titular leader of the American labor movement advert to the strike as a part of labor tactics. Labor's steady adherence to the right to strike may be inferred from what Mr. Green said about resistance to 'any attempt to force down to lower levels the earning power of the wage earners.' There is, of course, nothing new or surprising in that attitude, nor was it needed to make the position of organized labor clear in that respect. The significant aspect of Mr. Green's address was its freedom from the note of trouble-seeking belligerency. It contained little or nothing of the ranting which too often marks a leader concerned chiefly to create or support a reputation as an ugly man for employers to displease.

"If one is to seek grounds for criticism of President Green's remarks they must be found in some little confusion of thought over the relation between "living standards" and wage scales. Apparently, for the purposes of this speech, Mr. Green regarded the two as synonymous. There are conditions under which a wage reduction contributes to the preservation or improvement of living conditions. It is the adjustment of specific wage rates to the general price level and to the circumstances of a given industry which determines the real welfare of the wage worker. A more definite recognition of this fact would be genuine statesmanship on the part of any labor leader, as Mr. Lewis of the miners could testify if he would.

"It would be idle to imagine that high wage rates in and of themselves, without regard to the ratio between labor cost and the value of the product, were sufficient to create prosperity. Neither Henry Ford nor any other clear thinker supposes that to be the case. Without doubt Mr. Green would agree to this proposition in general terms; it is in its application to the case in hand that labor has too often lost its reasoning power.

"But by contrast with England, where on Monday the late and unlamented general strike found in labor's ranks stout defenders as one of the methods of democracy, the United States finds its manual workers at the moment in a mood to conserve their great gains rather than to gamble them recklessly on wild ventures."

Charles B. Gow, in *Industry*, while partly agreeing with the foregoing, is of the opinion that Capital has done its share in bringing about the present high standards of wages. He says:

"Among the many interesting economic phenomena of the hour none is more significant from the standpoint of the general public than that which has to do with the comparative trends of wages and commodity prices.

"Due to the working of the inexorable law of supply and demand, labor wages were carried to an unprecedented peak during and immediately following the war, reaching their maximum in the early months of the year 1920. Responding to like influences, prices advanced in a somewhat similar ratio so that the actual gain in purchasing power resulting from wage increases was comparatively slight.

"Since the year 1920 the average commodity price has declined to a figure approximately 20 percent less than that which obtained six years ago at the time when the maximum level was reached. Wages on the other hand during this same period have actually advanced in many important industries, in some cases by a substantial margin. Only in a comparatively few instances have there been offsetting reductions and these generally speaking have been relatively slight. The economic effect of such a condition is precisely the same as if prices had remained stationary and wages had been constantly increased, since with a fixed wage the worker has been able continually to buy more with the same income.

"Inasmuch as wages first and last constitute substantially 80 percent of the cost of all production it becomes a matter of interest to learn how this seeming paradox is accounted for.

"The answer is extremely simple. The ingenuity of management and the employment of enormous additional volumes of new capital have combined to supply the requisite methods and facilities needed to multiply the individual worker's output so that the resulting production costs have actually been materially reduced while still maintaining the high wage rate.

"Whatever may be said of the superior adaptability of the American worker to the new productive processes which have been responsible for these highly desirable results, the fact remains that he has been called upon for no sacrifice or contribution in connection therewith. He remains the chief beneficiary of the accomplishment but has not been required either to work longer hours or to expend additional energy. In fact, it is probable that he now is called upon for a lesser total effort than before.

"Brains and capital alone are entitled to full credit for whatever has been accomplished in this direction, yet there is little indication that either is more highly regarded than heretofore.

"The net wages paid to capital during the period in question has been particularly inequitable while its abuse and condemnation by the thoughtless and ignorant has continued with unabated fury.

"The major portion of our social and political evils would soon be eradicated if the masses of the American people could be fully awakened to a true understanding of the important function which large accumulations of capital serves in promoting their prosperity and progress."

Louisville Courrier-Journal
Right For Once

PUBLIC LAND QUESTIONS

(*Continued from page* 708)

farming. The government should no longer be obliged to open all areas of public lands, but discretion should be lodged in the Department to select only those of known agricultural value for homestead entry. An amendment to the homesteading laws would accomplish this object.

A law authorizing the establishment of grazing districts should be enacted. Protection of the native grasses, which are being destroyed by overgrazing and by a system which permits the unrestricted use of the public domain as a free range, demands that legislation of this character be promptly acted upon. Range control is necessary, if this natural resource is to be saved. The stock-raising industry will be benefited by this proposed law through security of tenure and the nation's interests safeguarded.

The Desert Land Act should be repealed. This law permits the acquisition of small areas of the public domain, providing settlers upon them can secure sufficient water for their irrigation. All such areas now seem to have been acquired and none is now available, due to the fact that waters of small streams located on the public domain have been appropriated. Arid lands now owned by the Government are so situated that their reclamation by irrigation requires the construction of immense dams and large canal systems involving enormous expenditures. The day has passed when an individual of limited means can select a tract of public land and secure its reclamation individually, at a reasonable cost.

The Timber and Stone Act is 50 years old. It provides for the outright sale of public timber land. Although strict regulations are now being enforced to prevent exploitation, this method of disposing of timber land precludes the preservation of the small amount of timber still remaining on the public domain. The Government should withhold this timber from sale in the future. There is no objection to the sale of stone deposits as provided in this act.

Under present law, the Interior Department is authorized to dispose of scattered tracts of land on the public domain not sufficient in size for a home. Its terms provide that these scattered areas may be added to holdings of a settler or other proprietor next to them and thereby converted to beneficial use. The size of tracts thus disposed of is limited to 160 acres. An amendment to the law increasing this limit to 320 acres should be enacted.

The present policy of developing and disposing of the mineral resources in the public lands is proving out. Discretion, however, should be lodged in the Department to withhold from lease where and when the market conditions are such that it would not be advisable to throw new or increased production into the channels of trade. The Government would then be able to develop these resources only as needed for use.

Unlike the mineral leasing law covering nonmetalliferous minerals and under which the minerals remain the property of the United States, the Federal mining laws provide for the disposition of the land itself, as well as the minerals found in it. I know of no valid reason for changing these statutes, which have stood the test of time protecting the interests of the prospector and the nation alike. It has been claimed that the fact that no notice is given the General Land Office of a mining location often leads to conflicts with homestead and other filings. No insurmountable difficulties, however, have been encountered in equitably adjusting them.

These different questions, although important, are but a few of the problems of the Public Land Service. Whether the United States or separate states, should own the land; who should have the proceeds from it in either event; the legal rights of the lessor and lessee; simplicity of administration; and, finally, the conservation of this undeveloped, natural, national wealth; all enter into and have their place in a dispassionate consideration of this subject, which is of vital and important concern to the whole country.

PUBLIC LAND STATES AND FEDERAL GOVERNMENT

(*Continued from page* 713)

streams. This must be resisted literally to the last "ditch." Every state, separately and all together, should prepare themselves to meet this last and greatest assault of Federal encroachment.

Future Policies and Legislation

As some concrete suggestions for the position that this congress should take in reference to these matters, I would suggest the following:

1. Repeal the mineral leasing act and proceed as we were before, under the general mining law, with such amendments as may be necessary to meet conditions of today. 2. If the leasing act can not be repealed, resist the inclusion of other and additional minerals thereunder. 3. Demand that all royalties received under the leasing act and grazing fees be repaid to the states of origin, excepting only the cost of administration. 4. Require that title to all school land sections be now settled and confirmed in the respective states. 5. That as rapidly as the reclamation fund will permit, construction of reclamation projects proceed. 6. Have all remaining public domain ceded back to the respective states wherein they lie, with all the resources they contain. 7. If this can not be accomplished, then let the Government authorize the sale of the remaining lands without homesteading it at a nominal price of from 50 cents to $1.00 per acre in the interests of the live-stock industry upon the assumption that the remaining lands are grazing lands only. 8. If not successful in this, then insist upon following the policy heretofore applied through all our history, of enlarging the area of homestead entries; provide for a stock-raising homestead of one section, with additional rights and a 90-day preference to existing entrymen. 9. Maintain the rights of these states to the waters of the states. 10. Consistently and persistently press all legislation which shall tend to bring all lands with all their resources, excepting the national parks and monuments, into state or private ownership, development and taxation. 11. Resist every piece of proposed legislation or interpretation of present law which in any way tends to extend, increase or strengthen Federal control of the lands and resources of the Western states. 12. Support every movement calculated to bring an end to the authority, possession and control of the general government over the areas within the states, except the parks and monuments, and except such as are constitutionally acquired by the Federal Government, by purchase and consent of the legislatures. Retire the Government, after 140 years, from the land business.

Let us complete the American system of local government over local things; stop centralization in Washington; eliminate bureau government; relieve the people generally of costly national machinery; perfect the sovereignty of the public land states, so that in deed and in truth we will be upon an equal footing with the 13 original and all the other states. We ask no more than they have had. We demand the status of states of a union, not provinces of a central power. We demand equality, equal dignity and authority. We demand that the plan of the American union be completed; that the process of building independent, sovereign republican states be perfected and that our citizens have equal rights, immunities and advantages with the citizens of the other states.

An international conference on bituminous will be held at Pittsburgh, November 15 to 19, under auspices of the Carnegie Institute of Technology. New uses for bituminous and improved methods of its utilization and combustion will be considered.

APPLIED GEOPHYSICS IN MINING

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will become possible. In all events, investigations with different methods should be carried out by the same company or the same experts, as the effective and correct combination of all methods and observations is essential for a real success. In such cases, where one or more geophysical methods still give doubtful results a single drilling may show the right way of interpretation, and may give the key for the geological condition not only for the local area in question but for a whole district. We can practically show an example of cooperation between gravimetric and electric measurements in figure 11 in Voester Bodden, northern Sweden. By the electrical measurements (method of Sundberg) a series of zones was located which seemed to be iron ore deposits, but as even thin sheets and impregnations of ore give strong electrical indications, engineers were doubtful if really everywhere payable ore bodies were to be found as the indications were too numerous. For this reason gravimetrical measurements (method of Exploration, Berlin) were made on the places of electrical indications. The result was that only in a part of these places real mass excesses were existing. In all cases where the torsion balance showed mass excesses ore bodies were confirmed by drilling.

Another example of combined investigation by torsion balance and seismic methods is shown in Figure 12 (both systems, Exploration, Berlin). It was a limestone deposit in northern Germany. On the gradient map a mass-deficit striking north-south within the area of the limestone was recognizable and was interpreted as an old river bed on the former limestone surface east of which the limestone came again near the present surface. The seismic investigations confirmed the correctness of the gravimetrical measurements, though the seismic method alone would not have given sufficient results. But by the seismic method an exact determination of depth was made possible, which with the torsion balance alone would not have been possible.

Thus, by both methods combined the geological conditions were fully cleared up. The result was a deluvial bed of clay with a thickness of 45 meters covered by 6-15 meters of sand and earth. Under the clay followed the limestone, which dipped about 15 meters from west to east and had a local depression near point AII. This local depression especially was confirmed by the seismic method. The profile of the surface of the limestone calculated from the seismic values is shown in the picture. These two examples show how useful and effective a combination of several methods can be.

A certain cooperation on a greater scale between gravimetric and seismic methods is already effective in the Gulf Coast. The major oil companies use both methods for the finding and outlining of salt domes, so that salt domes found by torsion balance measurements sometimes are checked and afterwards outlined by torsion balance.

The combined application of different geophysical methods is only beginning, but we are sure that this combination will be very effective and bring forth practical results of importance.

Finally we may state that the very value of geophysical methods is the reduction of actual and expensive drilling costs or similar expenses and the possibility to drop leases or concessions without wasting money at all for useless work, if the investigations show unfavorable conditions, and the concentration of money, energy and intelligence at the places which are suspicious for hidden treasures of mother earth.

PRACTICAL ELECTRICAL PROSPECTING

(*Continued from page* 738)

"Modern Geophysical Methods Used in Prospecting," by Hans Lundberg and Allen H. Rogers, in Mining and Metallurgy, May, 1925.

"Electrical and Electro-magnetic Prospecting," New York meeting, February, 1926, of the A. I. M. E.

"Instruments and Methods for the Discovery of Useful Mineral Deposits," by Dr. C. A. Heiland, Engineering and Mining Journal Press, January 9, 1926.

"Electrical Prospecting," Sweden, by K. Sundberg and H. Lundberg and J. Eklund, Geological Survey of Sweden Year Book 17, No. 8, Stockholm, 1925.

SCHOOL LAND TITLES IN PUBLIC LAND STATES

(*Continued from page* 720)

in the courts. It consists of a hearing before an official of the Interior Department and there is no appeal to the courts. The Government is a party to the suit and is at the same time the prosecutor, the judge and the jury. How is that for a "Kangaroo Court?" If the Government has a valid case why shouldn't it be willing to submit it to a court of competent jurisdiction, there to have it decided according to established rules of law and evidence? However, we have to fight these contests by the hundreds, and it is imposing a heavy burden of expense upon the state, all of which is unwarranted and should be unnecessary. At the same time the Government spends large sums of money in this so-called litigation. I commend this to the administration as a fine place to practice a little economy.

Much worse than this, however, and in some respects our greatest grievance is the matter of titles. In many instances the state has assumed that it owned a school section and has sold it in good faith to private parties who have spent large sums of money in improving it for farming or ranching purposes. Perhaps it has changed hands half a dozen times. This does not deter the Government from coming along when it gets good and ready and claiming it as mineral land. Hundreds of such school sections are now being contested by the Government, and the result is that titles to school lands are in a state of absolute chaos. Neither the state nor any innocent purchaser can ever be sure of a good title, even after a hundred years. Numerous contests have been instituted after 30 years of peaceable private possession. Our citizens are subjected to loss of the efforts of a lifetime, and the state is being deprived of the benefit of any mineral that may be found. The situation is intolerable, and is a travesty on justice. To paraphrase the language of a Supreme Court decision: it would be an insult to the good faith of Congress to suppose that it did not intend that the title, when it passed, should pass absolutely and not contingently upon subsequent discoveries, and that it would be a reflection upon the intelligence of Congress to believe that it intended the grant made in the enabling act to be or not to be a grant, depending upon subsequent developments.

I trust that I have made it clear that what we want is simply to get our title quieted and confirmed to the lands that were granted to us for the support of our schools and state institutions. I repeat that I am not speaking for Utah alone. All the public land states are involved in the problem, and I assume to speak for them all.

Our relief must come through congressional action. A bill satisfactory to the public land states passed the Senate at the last session, and is now pending before the House with a favorable committee report. We hope to get it passed in December, and we solicit the friendly support of the organizations which are holding their sessions in Denver this week.

The Federal Reserve Board reports that production of steel ingots, zinc and petroleum increased in August, while the output of pig iron, coal, and copper was smaller than in July. Shipments of ore and coke were larger in August than in the same month of previous years. Prices of fuel and metals increased.

PRODUCTION OF CLAY IN 1925

THE quantity of clay sold by producers in the United States in 1925 amounted to 4,030,420 short tons, valued at $12,736,632, or $3.16 a ton, according to a statement made public by the Bureau of Mines. These figures show an increase of 9 percent in quantity and 11 percent in value compared with 1924. They represent only clay sold as clay or mined under royalty and do not include the much greater quantity of clay that was burned into clay products by the producers themselves from their own property. The data were collected direct from producers in 43 states and in cooperation with the State Geological Surveys of Alabama, Florida, Georgia, Illinois, Iowa, Maryland, Michigan, Missouri, New Jersey, New York, North Carolina, Texas, Virginia, Washington and Wisconsin. The leading five states in the order of the quantity of clay sold were Pennsylvania with 19 percent of the total quantity, Missouri with 11 percent, New Jersey with 9 percent, and Georgia and Ohio with about 8 percent each.

The sales of kaolin, the clay that is used in making high-grade pottery and porcelain, as well as paper, oilcloth, and other products, and which is generally considered the highest grade of clay, amounted to 367,319 tons, valued at $3,220,719, an increase of 12 percent in quantity and 10 percent in value as compared with 1924. The clay of largest quantity and value is fire clay. The sales of fire clay in 1925 were the largest ever recorded—2,566,934 tons—and were 5 percent greater than those of 1924, the year of largest output previous to 1925. The value of the fire clay sold in 1925 was $7,312,349, an increase of 9 percent as compared with 1924 and an increase of 3 percent as compared with 1920, the year of greatest value of fire clay previous to 1925. The sales of clay of every kind increased in quantity and value in 1925, as compared with 1924.

The imports of clay decreased in quantity and value and the exports increased in quantity and value in 1925, as compared with 1924. The imports of clay amounted to 436,815 short tons, valued at $3,832,225, a decrease of 2 percent in quantity and 4 percent in value. Exports of clay in 1925 amounted to 83,043 tons, valued at $881,566, an increase of 14 percent in quantity and 20 percent in value, as compared with 1924. Kaolin, or china clay, constituted 85 percent of the total imports in 1925. Fire clay, the principal clay exported, amounted to 53 percent of the total.

CLAY SOLD BY PRODUCERS IN THE UNITED STATES IN 1924 AND 1925

Kind	1924 Short tons	1924 Value	1925 Short tons	1925 Value
Kaolin	326,611	$2,923,965	367,319	$3,220,719
Ball clay	83,034	581,966	109,607	699,427
Slip clay	5,910	31,023	7,349	37,397
Fire clay	2,443,710	6,737,063	2,566,934	7,312,349
Stoneware clay	59,194	117,142	77,438	162,161
Miscellaneous	772,660	1,116,377	901,773	1,304,579
	3,691,119	$11,507,536	4,030,420	$12,736,632

PRODUCTION OF NATURAL ABRASIVES IN 1925

THE total quantity of natural abrasives sold by producers in the United States in 1925 was about 194,000 short tons, valued at over $4,000,000, according to a statement made by the Bureau of Mines and compiled from individual reports furnished by producers. In addition, there were manufactured and sold during the year 88,530 short tons of artificial abrasives, valued at $7,988,930.

NATURAL ABRASIVES SOLD BY PRODUCERS IN THE UNITED STATES, 1924-25

Abrasives	1924 Short tons	1924 Value	1925 Short tons	1925 Value
Diatomaceous earth	63,163	$693,917	73,030	$922,281
Emery	2,195	19,756	769	5,907
Garnet	8,290	674,176	8,429	712,853
Grinding pebbles and tube-mill lining	2,532	37,429	3,831	50,147
Grindstones	28,991	852,260	28,970	864,637
Millstones, chasers and dragstones	*	30,125	*	22,490
Oilstones, whetstones, hones, scythestones, and rubbing stones	1,056	258,943	970	272,224
Pulpstones	9,193	814,409	8,370	841,302
Pumice	43,651	190,253	40,380	179,020
Tripoli	28,476	389,409	29,388	434,886

* Quantity not reported by weight.

FIRE DAMP IN MINES

(*Continued from page* 748)

joining mine in the same seam. The two mines are about identical as regards geological conditions and depth of coal and were opened up at the same time and maintained practically the same coal output for several years. Physical conditions are identical as nearly as can be described in these two mines, yet the gas charts are entirely different. In Figure 2 the gas flow has evidently not reached its maximum. It illustrates again that the flow does not cease with the discontinuance of coal mining.

In Figure 3 is illustrated the case of a mine in the Pittsburgh seam of the Fairmont region that is nearing exhaustion. This mine was originally opened about the year 1854, by a drift in a tract of coal of 1,800 acres. In 1888 a shaft was sunk to a depth of 125 feet in a more central location. Within the last 10 years the adjoining territory on all sides has been completely developed. The diagram indicates that a reduction in the flow of gas may be expected after the territory has been fully developed.

In Figure 4 is illustrated the case of a mine in the No. 4 Pocahontas seam of coal in McDowell Co., W. Va. This is a shaft mine 565 feet deep in virgin territory. The maximum and minimum lines indicate the highest and the lowest daily result during the month. The average indicates that during the first year the rate of flow of gas follows closely the rate of development. It also shows that the flow may fall off very materially for no perceptible reason.

In Figure 5 daily results are plotted for a period of about 3 months with the corresponding daily output of the mine and also the record of the barometer during the same period. This is a shaft mine 560 feet deep in the No. 4 Pocahontas seam of coal and has been operating about 10 years.

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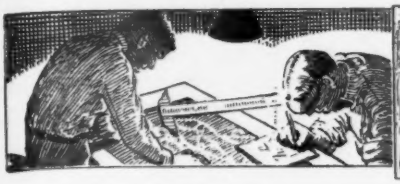

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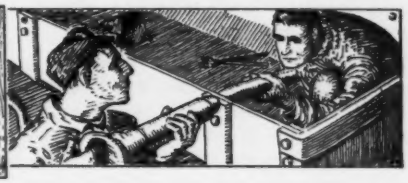


New Oil Circuit Breakers

A new line of General Electric oil circuit breakers is designed for either indoor or outdoor service on systems of relatively large capacity. These are available in sizes of 400, 600, 800 and 1,200 amperes and voltages of from 15,000 to 88,000 inclusive. They bear the General Electric designations FK-236 and FHK-236.

The breakers rated at 73 kilovolts or less may be used up to altitudes of 10,000 feet. The 88-kilovolt breakers are equipped with "high altitude" bushings when used above 4,000 feet. The range of interrupting capacities for the FK-236 breakers is from 2,000 to 7,000 amperes, and from 3,300 to 14,000 amperes for the FHK-236 type.

Each triple-pole breaker is made up of three single-pole, single-throw units operated by a single mechanism. This mechanism may be manually operated or electrically operated by either a solenoid or a motor.

Unit mechanisms are totally enclosed within the breaker frame and are, therefore, freed of any tendency to reclose under the action of unbalanced internal pressures which may be set up when opening under abnormal conditions. A larger air space is thus also provided with consequent increase of interrupting capacity.

Of the two forms, the type FK-236 uses finger and blade contacts, while the type FHK-236 is equipped with plunger or rod type contacts and explosion chambers. With explosion chambers, higher interrupting capacities are obtained, although both types are adequate for the service for which they are rated.

G. E. Makes New Compensator

To meet the demand for a compensator which will cover ratings above 30 horsepower on 220-volt circuits and 60 horsepower and up on 440 and 550-volt circuits, the General Electric Co. has introduced a new design designated as Size No. 2. Two-part construction is employed in order to meet a wide variety of installation requirements.

One unit of the compensator consists of an oil-immersed, double-throw switch with temperature overload relay, push button station and undervoltage release. The other unit consists of an auto-transformer. Each unit is provided with a conduit box.

The control box is so arranged that the oil box may be lowered to allow examination of the switch parts and renewal of fingers and wedges. This unit can be wall mounted or attached to a pipe support.

The auto transformer is inclosed in a cast iron box with a removable cover to allow changing tap connections when desired. The conduit box mounted on the top of this case provides ample room for making connections. The front of the conduit box is removable, the entire interior thus being accessible in order that joints may be tightened and properly taped.

Making Strip Mining Less Expensive

The American Cable Co., Chicago, furnishes the following story on how to lessen costs in strip mining:

"While perhaps less expensive, by reason of the reduced footage, wire rope is as important a piece of equipment in strip mining as in shaft mining. For a steam shovel to be rendered inoperative, by reason of a failure in wire rope, is an emergency as crippling to the strip mine as a broken hoist rope is to a shaft operation.

"Within recent years wire rope has undergone a fundamentally basic change in method of fabrication—to the distinct benefit of all mine operators. This change has come about in the development of the preformed principle—the preforming or preshaping of the wires and strands that enter into the construction of the completed rope. The employment of this principle eliminates the necessity for twisting by force, the wires and strands into place, for which reason there is an almost complete absence of the internal torsional stress found in the old time wire rope. That this absence of stress and internal strain greatly affects wire rope life and efficiency has recently been proved by the experience of the Woodman-Vincent Coal Co., of Pittsburg, Kansas. According to a letter from Mr. J. H. Vincent of this strip mine operating company the preformed wire rope used as a replacement on their Marion electric shovel has already moved more than twice the yardage formerly moved by any previous rope.

"Service very similar to this was experienced by the Southern Kansas Coal Co., at Scammon, Kans. Henry Jenkins, superintendent, tells us that he is now using 140 feet of three-fourths-inch, 6 by 25 spacer seale, Improved plow steel, Tru-Lay brand wire rope on his Bucyrus coal loader and 320 feet of 1⅛-inch, 6 by 25 Spacer seale preformed Lang Lay on his 250 Marion steam shovel. It seems these ropes, furthermore, are more easily handled since they resist kinking and have little or no tendency to unstrand or high strand.

"To relate the above incidents would be of little value, in itself, if it were not pointed out, that only by keeping abreast of the new developments in equipment or the constantly recurring mechanical perfections can the mine operator hope to bring about the absolute minimization of operating costs. No industry has completely automatized its operations, and no industry has reduced its producing expenses to the irreducible minimum. Much has been done toward this end, in the mining industry, but much remains to be done. The accomplishment of this desired end can best come through the knowledge of and willingness to adopt new methods or equipment as they arise."

A New Insulating Material

A new type of insulating material which is being used by the General Electric Co. for the production of radio high-frequency insulators not only solves the problem of an improved insulator for such high frequencies as are encountered in radio work, but also solves a problem in more efficient utilization of materials. The new insulation, known as Mycalex, is a composition of ground mica and lead borate.

Mica previously presented a difficult problem because of the enormous waste, it being estimated that only 5 percent of the material taken from the mines could be used. In manufacturing, there were further wastes of small pieces of mica, but some years ago it was found that these mica flakes, mixed with a binding material and compressed under heat, made very good insulation. Such sheets of prepared mica are used by the General Electric Co. in many manufacturing processes. And now a product has been developed which utilizes mica particles, so that even more of the mineral is used.

Coppus "Vano" and "Ventair' Blowers and Exhausters

According to a bulletin recently issued by the Coppus Engineering Corporation, the work performed by a miner is greatly influenced by the condition of the surrounding air. Actual tests have shown that the output of a mine may be considerably increased by installing an up-to-date ventilating system without having recourse to additional labor.

Bulletins descriptive of their "Vano" and "Ventair" blowers and exhausters, especially designed for mine ventilation purposes, are now ready for distribution —No. 121, "Vano and Ventair Blowers and Exhausters" (compressed air driven) and No. 115, "Vano Blowers, Steam Turbine, Air Turbine, or Electric Motor Driven." Another bulletin on "Electric Motor Driven Vano and Ventair Blowers" is shortly to be issued.

The "Vano" is a medium pressure propeller fan, delivering comparatively large volumes of air, and has an efficiency as high as 80 percent for both high and low pressure. The air enters and leaves in the same direction—parallel to the axis, with unrestricted passage through the machine. The Vano is installed in the duct like a piece of pipe or a valve. Power consumption is constant at constant speed, irrespective of length or diameter of duct. The ring carrying the air turbine buckets is shrunk around the periphery of the aluminum fan. This single unit is carried by a heavy shaft supported by two liberally oversized deep groove ball bearings.

The "Ventair" is a high pressure centrifugal blower. Its fan has non-overload characteristics. A ring carrying the turbine buckets is shrunk on the back side of the aluminum fan. This leads, in a similar way as with the Vano, to single unit design, one heavy shaft supported by two large ball bearings. Some of the features of the Vano and Ventair are low air consumption, high efficiency, light weight (portable), and compactness of design.

Coppus engineers point out that the complex of secondary mine ventilation can not be solved by one type of fan. It is theoretically and practically wrong to indiscriminately use a centrifugal fan. One job may require a medium pressure propeller fan and another proposition may call for a high pressure centrifugal fan. The former is represented by the Vano, which is of the volume type, whereas the Ventair has the characteristics of a centrifugal blower. Therefore, in order to aid in the selection of the right type of Coppus fan for a duct of given length and diameter, a table is included in Bulletin 121, listing their various types, and giving the air delivery and compressed air consumption of each type under respective conditions.

Large mines, in many cases, have special ventilating engineers. Mines of medium and small size are invited to secure the cooperation of the Coppus engineers in solving any of their problems.

Copies of the bulletins mentioned may be obtained by addressing the Coppus Engineering Corporation, Worchester, Mass.

Metal Melting Pot

A new metal melting pot, with a capacity of approximately 1,000 pounds, has been added to the General Electric line and is now on the market. This pot, utilizing the electric heating principle, is practically the same as other standard General Electric melting pots except that three cast-in, sheath wire immersion heating units are used instead of two.

Each heating unit is rated 5 kilowatts. The pot may be operated either on 110 or 220-volt, a.c. or d.c. circuits and the use of three heating units will also permit balanced 3-phase operation.

The pot itself consists of a sheet steel, cylindrical casing in which is supported a cast-iron crucible of the following dimensions: Inside—18 inches in diameter and 15 inches in depth. Outside—29 inches in diameter and 31 inches in depth. The space between the casing and the crucible, measuring about three inches, is efficiently insulated with a compact heat insulator. The leads of the heating units are brought over the top of the pot into a connection box fixed to the unit itself.

Melting pots of this type are designed for melting lead, babbitt, tin, solder and similar alloys or metals, except spelter or zinc, at temperatures not exceeding 850 degrees.

Full-automatic control is recommended, consisting of a standard automatic control panel and a temperature control instrument equipped with a special bulb for metal immersion.

Separate heating units may be installed in existing installations of melting pots where dimensions permit and where temperatures do not exceed 850 degrees F.

International Welding Exposition

One of the largest Welding Expositions will be held in connection with the annual fall meeting of the American Welding Society, Buffalo, N. Y., November 17, 18 and 19, showing new developments in welding apparatus and supplies. A unique feature of this exposition will be an exhibit of a large variety of welded products.

Technical sessions include authoritative papers and discussions on "The Design and Development of Welding Apparatus"; "Organization of Welding on the Railroads"; "Welding of Locomotive Parts"; "Welding Science in the Engineering Curriculum of Universities"; and "Arc Welding in a Gaseous Atmosphere."

On Friday afternoon, November 19, 1926, an inspection trip has been arranged to Niagara Falls. Members of the Society and their guests will view the Falls from the American side with a short inspection trip through the Niagara Falls Power House. This will be followed by a buffet supper on the Canadian side and then a special illumination of the Falls will be shown, returning to Buffalo late in the evening.

A meeting of the American Bureau of Welding and of the Welding Wire Specifications Sub-Committee will be held November 18.

Southern California Edison Co. to Have Largest Electric Generators in World

Two electric generators, each nominally rated at 90,000 kilowatts at 90 percent power factor or 100,000 kilowatts at unity power factor, the world's largest in both capacity and physical dimensions, and to be driven by the two largest tandem-compound turbines ever made, are being manufactured by the General Electric Co. for the Southern California Edison Co.

Two unusual features have been incorporated in these machines. The armatures are being built with special heavy construction so as to be gas-tight, for the possible future adoption of the new system of hydrogen cooling. The machines are also the first to combine a double-flow low-pressure end and four vertical condensers; with advantages of a simplified foundation and increased space for removal of condenser tubes.

The armatures of these generators, each weighing 330,000 pounds, are of such size that they will be assembled at Los Angeles. Even if railroad cars with a capacity of 165 tons were available, shipment by rail would still be impossible because of track, bridge and tunnel clearances.

The heaviest pieces to be shipped from Schenectady will weigh 230,000 pounds each. These will be the revolving fields of the main generators. The total length of the turbine-generators will be 103 feet each and the total weight of each 1,650,000 pounds.

The turbines are of the tandem-compound type, with a rating of 94,000 kilowatts at 90 percent power factor or 100,000 kilowatts at unity power factor.

A tandem-compound turbine has all of the equipment mounted on the same shaft, and only one main generator is used. In the cross-compound turbine there is a division of elements, with high pressure steam driving one electric generator and low pressure steam driving one or more generators on other shafts.

Each of the main generators operates at 1,500 revolutions per minute. They will be the first to produce current at 16,500 volts. In addition to the main generators, each unit is equipped with a house service generator on the same shaft, rated at 4,000 kilowatts at 80 percent power factor or 5,000 kilowatts at unity power factor.

The steam turbines driving the generators receive steam at a pressure of 400 pounds gauge and a temperature of 725 degrees Fahrenheit. The exhaust steam is at a pressure of one inch absolute, so that practically all of the energy of the steam is extracted by the turbines. The boilers which will supply steam to the turbines will be heated with either natural gas or oil as fuel.

Two years ago a record for turbine generators in the west was set by the two 35,000-kilowatt units supplied by the General Electric Co. for the Long Beach station of the Southern California Edison Co. This record was broken by the General Electric 52,800 kilowatt unit which was recently started in operation in the same station, and now a record is to be broken by the Southern California Edison Co. not only for the west but for the world.

Timken Appoints New Engineer

Effective immediately, C. H. Johnson has been appointed Engineer, Service Department, of The Timken Roller Bearing Co. He will have direct charge of the installation of Timken Bearings in automotive and industrial applications. Mr. Johnson's experience in this field, with the Timken company qualifies him particularly well to direct this class of work.

Dever C. Ashmead, formerly in charge of the anthracite office of the Bureau of Mines at Wilkes-Barre, Pa., has resigned to take effect October 1, and will affiliate with the Hydrotator Co. on that date in the capacity of vice-president, in charge of the Coal Division, with offices at Wilkes-Barre.

The latest work Mr. Ashmead did was an exhaustive report made under the auspices of the United States Bureau of Mines and the Water Power and Resources Board of the State of Pennsylvania on the subject of silt production and disposal. This subject is in direct line with the work the Hydrotator Co. is doing in the anthracite field.

Austin Builds New Plant

The Reliance Electric & Engineering Co., Cleveland, has just placed a contract for a new addition to its main plant with The Austin Co., Engineers and Builders. The new unit will be 40 by 80 feet, two stories high and will greatly increase the production in the Winding Department. Aisles on the first floor will be served by 3-ton traveling cranes. Construction was started last week. The iron work will be completed in 40 working days, according to The Austin Co. This is the fifth plant extension on The Reliance Electric tract in the past 14 years.

The company manufactures d.c. motors from 1 to 250 H.P. with a complete line of polyphase induction motors from 1 to 60 H.P. motors, largely used in iron and steel, textile and paper manufacturing industries.

"Business has been maintained at peak throughout the summer," Mr. C. V. Putnam, Secretary, states. "Our line of alternating current induction motors is largely responsible for the necessity of increasing production. A large part of the demand has come from the automotive industry."

Mr. Clarence L. Collens is president of The Reliance Electric & Engineering Co.

New General Manager, George Cutter Company

Mr. Carl G. Schluederberg has been appointed general manager of the George Cutter Co., South Bend, Ind., according to announcement made by Mr. F. A. Merrick, Vice-President and General Manager of the Westinghouse Electric and Manufacturing Co.

The George Cutter Co. is a subsidiary of the Westinghouse Electric Co., in which street industrial and commercial lighting equipment and battery chargers are manufactured. The appointment is effective immediately.

In his duties as general manager of the George Cutter Co., Mr. Schluederberg will be in charge of all the operations by and through that company, including sales, engineering and manufacturing. His appointment was made in anticipation of the departure of Mr. Warren Ripple, Vice-President and Treasurer of the George Cutter Co., who, on account of ill health, has been impelled to tender his resignation, which has been accepted as effective September 30.

Mr. Schluederberg, who has been assistant to the managers of both the Supply and Merchandising Departments of the Westinghouse Electric and Manufacturing Co., has recently been director of the Westinghouse company's exhibit at the Sesquicentennial Exposition in Philadelphia.

New Branch Office Opened By Link-Belt

A new branch office has just been opened in Utica, N. Y., at 107 Foster Building, 131 Genesee St., by Link-Belt Co., of Chicago, Philadelphia and Indianapolis.

This, their thirty-fourth office, and the third within the State of New York, is to be devoted especially to the sale of Link-Belt Silent Chain and Link-Belt Roller Chain; and will be in charge of Mr. F. P. Hermann, Jr., who has had many years of Silent Chain experience and contact while located in the New York office of that company.

Westinghouse Engineering Department Reorganized

Reorganization of the General Engineering Department of the Westinghouse Electric and Manufacturing Co. has been announced by H. W. Cope, Assistant Director of Engineering.

The reorganization has necessitated the re-allocation of several engineers, four being elevated to Managers of Engineering. These are F. C. Hanker, manager of Central Station Engineering; S. B. Cooper, manager of Railway Engineering; G. E. Stoltz, manager of Industrial Engineering and W. E. Thau, manager of Marine Engineering. S. A. Staege, formerly section engineer in charge of the paper mill section, has been appointed Industrial Engineer giving particular attention to the paper mill industry.

Other appointments, also announced by Mr. Cope, are:

Central Station Engineering—C. A. Powel, Engineer, Generating Station Engineering; R. D. Evans, Engineer, Transmission Engineering, and C. A. Butcher, Engineer, Substation Engineering.

Railway Engineering—H. K. Smith, Engineer, Heavy Traction Engineering; G. M. Woods, Engineer, Light Traction Engineering, and A. H. Candee, Engineer, Gas-Electric Traction Engineering.

Industrial Engineering—E. M. Bouton, Engineer, Elevator Engineering; C. W. Drake, Engineer, General Industrial Engineering; C. T. Guildford, Engineer, Textile Engineering; C. H. Matthews, Engineer, Mining Engineering; O. Needham, Engineer, Steel Mill Engineering; J. W. Speer, Engineer, Material Handling Engineering; W. W. Spratt, Engineer, Paper Mill Engineering, and E. B. Dawson, Engineer, Electrochemical and Electrometallurgical Engineering.

The appointment of Mr. N. W. Storer as Consulting Railway Engineer in charge of the group handling of Diesel-electric locomotives and rail cars has been announced by Mr. R. S. Feicht, Director of Engineering.

All appointments are effective immediately.

Timken Host to Automotive Engineers

The Cleveland section of the Society of Automotive Engineers were guests of The Timken Roller Bearing Co., September 16, when about 100 members of the society availed themselves of the opportunity to visit the Timken plant. Nearly all were from the Cleveland district, although a number came from more distant points.

Every important process was shown from the manufacture of the electric furnace steel in the largest plant of its kind in the world; the modern 35-in. blooming mill; automatic machines which simultaneously grind the end of the roll and sort them into sizes differing by only .0001-in.; multiple perforating and winging machines which make the one-piece precision cage; the world's largest grinding department and all the other precise operations which go to make the Timken Bearing; down to the final assembly of the finished product.

Immediately after the inspection trip, which took about two hours, lunch was served at Congress Lake Country Club, followed by an athletic program, which included golf, races and other events. Dinner was served in the main dining room of the clubhouse after which the prize winners were announced.

The address of the Pittsburgh office of the Ironton Engine Co., is now 210 Second Ave. The Weinman Pump & Supply Co., from that address will be glad to have sales engineers give all information regarding Ironton products.

The Relation Between Spacing, Size of Bore Holes and Strength of Dynamite in Quarry Blasting, is the title of an article by R. H. Summer, in the September number of the DuPont Powder Co.'s Explosives Service Bulletin.

Pamphlet on Blasting Caps

Atlas Powder Co., Wilmington, Del., has issued a new pamphlet on Electric Blasting Caps, which is available to interested parties upon request to the company.

Allis-Chalmers Issues New Catalog

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just issued a new Bulletin, No. 1819-A, entitled "Electric Hoists." The bulletin is handsomely printed, and completely illustrated. It contains a wealth of material for those interested in this subject, and copies may be obtained by addressing the Milwaukee office.

New O-B Catalog

The new No. 20 O-B general catalog is now being distributed by the Ohio Brass Co., Mansfield, Ohio. This book of 945 pages, exceeding the previous edition by 175 pages, includes complete listing of all O-B porcelain insulators, trolley and line materials, rail bonds, car equipment and mining materials. It is logically divided and thumb-indexed for the well-defined classes of products of this company. In addition to descriptive and listing information, there are many helpful suggestions for the man concerned with the installation of these products.

Arrangement of the products in the Trolley Materials section of the book is even more convenient than heretofore. Included in this grouping are numerous new products developed and offered to mines since the last edition of the catalog.

The books are carefully indexed and convenient cross-references are plentiful.

A new bulletin by the General Electric Co. deals with Type MT control equipment for direct current series wound crane, bridge, and trolley motors.

It is understood that there are possibly 400 Fairbanks dredges in the field. All owners of dredges or other Fairbanks equipment are requested to write to The Osgood Co., giving the present location of their machinery, its size and number, in order that prints, drawings and other records may be properly placed in shape for the expedious handling of repair orders when received. Correspondence relative to equipment of Fairbanks manufacture should be addressed to The Osgood Company, Marion, Ohio.

A Long-Lived Loader

In service at the W. H. Pugh Coal Co., of Racine, Wisc., since 1913, is an old time Link-Belt shaker screen wagon loader. The yard was originally a hard coal yard, but of late years a trade for West Virginia Pocahontas has been developed. The loader, though now a full 13 years old, is still quite hale and hearty, as is evidenced by the fact that last year it handled 12,000 tons of the Pocahontas coal. This coal is handled by boat to Racine, and is unloaded on the docks by self-unloading boats. About 3,500 tons of coal are shown in the photograph. The coal is nut size, and is screened by the loader, the screened nut being sold to the retail users; and the screenings to a malleable iron foundry in Racine. The screenings are handled from the wagon loader by a 31-ft. center Link-Belt Portable Belt Conveyor to a storage pile, from which they are reclaimed by two more wagon loaders of the same manufacture.

Improved Resistor Terminals

General Electric resistors are now equipped with a new and improved terminal, simplifying their installation. Only one size is needed for all currents up to 225 amperes, thus simplifying the spare part situation. The mechanical construction is so improved that making connections or changing taps in difficult locations is simplified, and soldering is unnecessary to secure stranded cable. Wiring, when used with the G. E. standard unit box resistor scheme, is much simplified.

For use with those control installations where starters do not incorporate temperature overload relays, temperature overload protection may now be secured by using a new design of auxiliary panel on which a temperature overload relay may be mounted. This panel is equipped with a new resetting feature now available for installation with practically any control using such relays. This is a device which allows external resetting by means of a cord.

A special installing wrench for mounting relays in those panels and switches which do not contain them has been designed and is delivered as part of the control equipment with which they are needed. With this wrench the danger of damage to the thermostatic strips in installing is minimized.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October 1, 1926.

City of Washington,
District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared R. S. Mowatt, who, having been duly sworn according to law, deposes and says that she is the assistant business manager of the MINING CONGRESS JOURNAL, and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:

Name of publisher, The American Mining Congress; post-office address, Washington, D. C.

Editor, E. R. Coombes; business manager, Burton Bunch.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock): The American Mining Congress—a corporation, not for profit. No stockholders. Hugh Shirkie, president, Terre Haute, Ind. E. L. Doheny, first vice-president, Petroleum-Securities Bldg., Los Angeles, Calif. Wm. H. Lindsey, second vice-president, Nashville, Tenn. Robt. E. Tally, third vice-president, Clarkdale, Ariz. J. F. Callbreath, secretary, 841 Munsey Bldg., Washington, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): None.

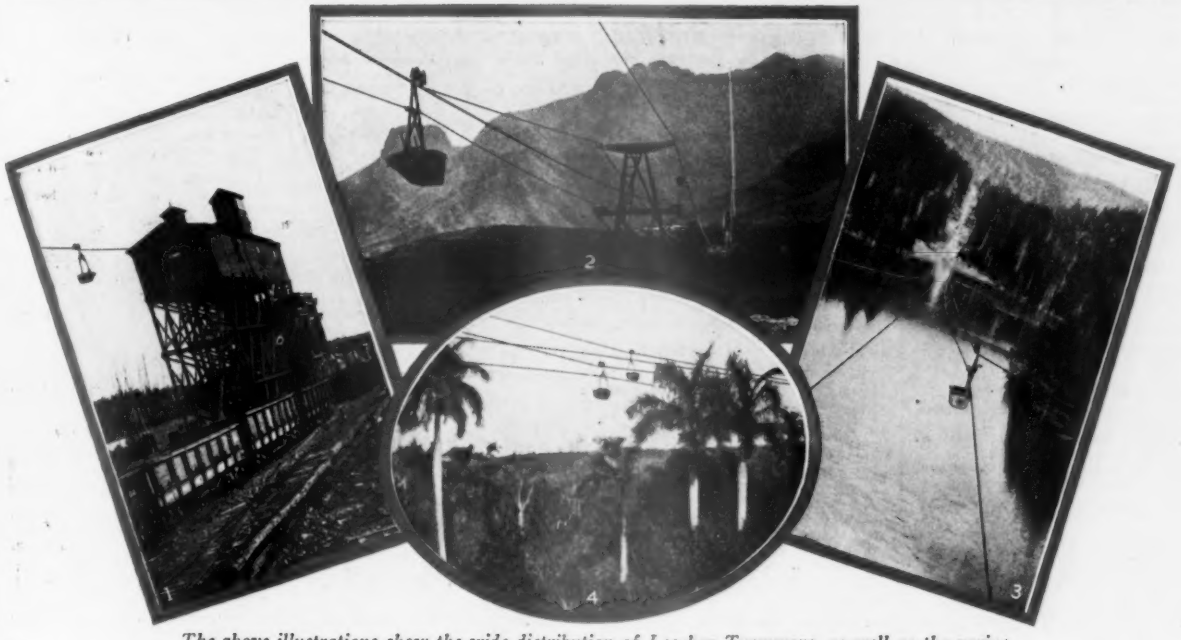
R. S. MOWATT,
Assistant Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1926.

[SEAL.] THOMAS C. WILLIS.

(My commission expires January 10, 1927.)

"LESCHEN"



The above illustrations show the wide distribution of Leschen Tramways, as well as the varied conditions under which they are working: No. 1—General Chemical Co., in Ontario, Canada. No. 2—Teziutlan Copper Company, in Mexico. No. 3—Anaconda Copper Mining Co., in California. No. 4—American Metal Co., in Cuba.

AERIAL TRAMWAYS: The extensive adoption by the mining industry of the Leschen Systems of Aerial Tramways is recognition of their suitability, sturdy construction and economical performance. While they are often used under conditions where no other method of transportation is practicable, they are also installed in direct competition with other methods, as they are cheaper in the long run.

Our engineers will gladly give you any desired information on the advantages of aerial transportation. If you have a transportation problem, you will find our Catalog No. T-25 very interesting.

WIRE ROPE: Leschen Wire Rope has a long and well-known record for economical service in the mining industry. For use on heavy-duty hoists, inclines, dredges and steam shovels, we recommend HERCULES [**Red Strand**] Wire Rope. Its extra strength, elasticity, toughness, and durability make it an important factor in reducing operating costs.

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ACETYLENE GENERATING APPARATUS
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Irvington Smelting & Refining Works, Irvington, N. J.

AERIAL TRAMWAYS
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Ingersoll-Rand Co., 11 Broadway, New York City.

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Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

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American Mine Door Co., Canton, Ohio.

AUTOMATIC SWITCH THROWERS
American Mine Door Co., Canton, Ohio.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)
Prest-O-Lite Co., 30 East 42nd St., New York City.

BEARINGS (Roller)
Hyatt Roller Bearing Co., Harrison, N. J.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BELTING, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

BINS (Coke and Coal)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BIT SHARPENERS
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

BLACK DIAMONDS
R. S. Patrick, Sellwood Building, Duluth, Minn.

BLASTING POWDER
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

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Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

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Amer. Mine Door Co., Canton, Ohio.

BREAKER MACHINERY
Vulcan Iron Works, Wilkes-Barre, Pa.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

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BUCKETS (Elevator)
Hendrick Mfg. Co., Carbondale, Pa.
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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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American Steel & Wire Co., Chicago and New York.

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American Mine Door Co., Canton, Ohio.
Leschen & Sons Rope Co., A., St. Louis, Mo.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

CAGE (Safety Appliances)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGERS, AUTOMATIC
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
Mining Safety Device Co., Bowerston, Ohio.

CAGES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

CAGES (Self-dumping)
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

CAGE STOPS AND LOCKS
Mining Safety Device Co., Bowerston, Ohio.

CALCINERS
Vulcan Iron Works, Wilkes-Barre, Pa.

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R. S. Patrick, Sellwood Building, Duluth, Minn.

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Oxweld Acetylene Co., 30 E. 42nd St., New York City.

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Oxweld Acetylene Co., 30 E. 42nd St., New York City.

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Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CAR STOPS (Automatic)
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

CAR WHEEL BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CASTINGS, GRAY IRON
Vulcan Iron Works, Wilkes-Barre, Pa.

CASTINGS, OPEN HEARTH STEEL
Vulcan Iron Works, Wilkes-Barre, Pa.

CHAINS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

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Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
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Morse Chain Co., Ithaca, N. Y.

CHAINS, SLING
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Morse Chain Co., Ithaca, N. Y.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CLAMPS, HOSE
Knox Mfg. Co., Philadelphia, Pa.

CLAMPS (Trolley)
Ohio Brass Co., Mansfield, Ohio.

CLUTCHES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL CLEANING MACHINERY
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

COAL COMPANIES
General Coal Company, Land Title Bldg., Philadelphia, Pa.
Lehigh Coal & Navigation Co., Philadelphia, Pa.
Thorne, Neale & Co., Philadelphia, Pa.

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Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Vulcan Iron Works, Wilkes-Barre, Pa.

COAL CUTTERS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
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Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

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COAL LOADERS
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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

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Ingersoll-Rand Co., 11 Broadway, New York City.

COMPRESSORS, MINE CAR
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CONDENSERS
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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, CHAIN FLIGHT
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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Conveyor Sales Co., Inc., 299 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, SCREW
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COOLERS, ROTARY
Vulcan Iron Works, Wilkes-Barre, Pa.

CORE DRILLING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

COUPLINGS, FLEXIBLE
Fawcus Machine Co., Pittsburgh, Pa.

COUPLINGS, ROCK DRILL
Knox Mfg. Co., Philadelphia, Pa.

CROSSINGS AND CROSSOVERS
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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CRUSHERS, COAL
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHERS, SINGLE & DOUBLE ROLL
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DECARBONIZING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DESIGNERS OF PLANTS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

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R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, BLACK (See Carbon and Bortz)
R. S. Patrick, Sellwood Building, Duluth, Minn.

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American Mine Door Co., Canton, Ohio.

DOUBLE CRIMPED WIRE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

DRIFTERS, DRILL
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DRILLING, DIAMONDS FOR
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DRILLS, AIR AND STEAM
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Blast Hole)
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, CORE
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ELECTRIC
General Electric Co., Schenectady, N. Y.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

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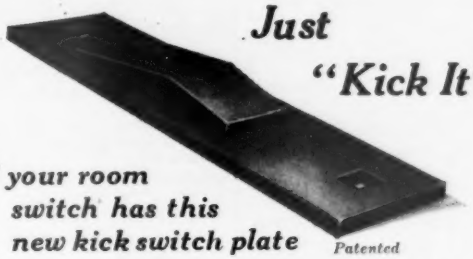

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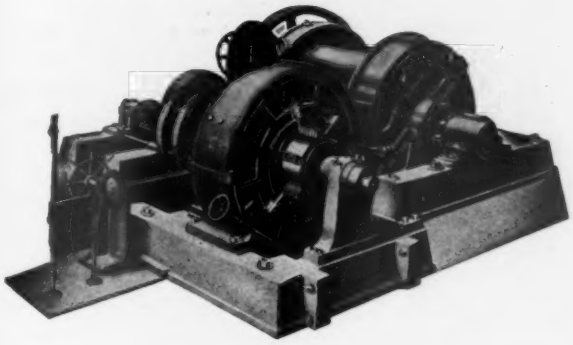

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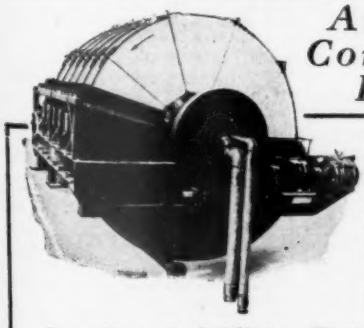

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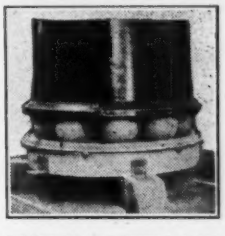

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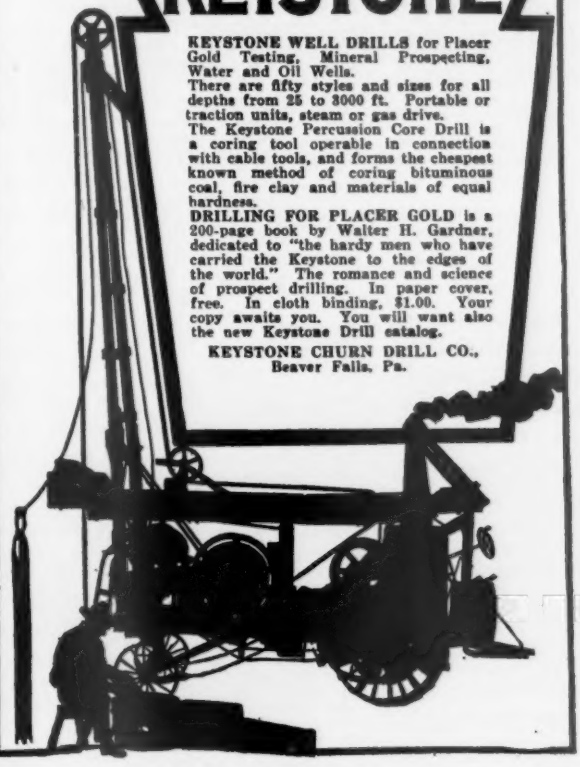

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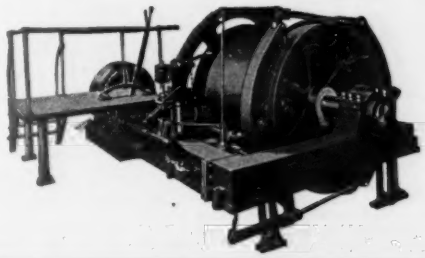

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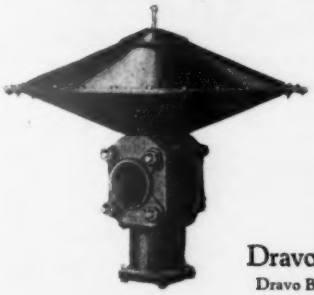

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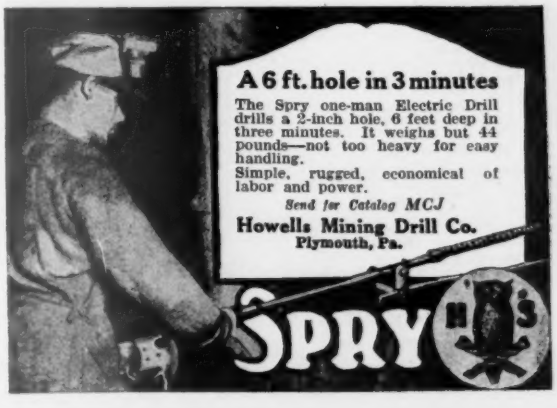
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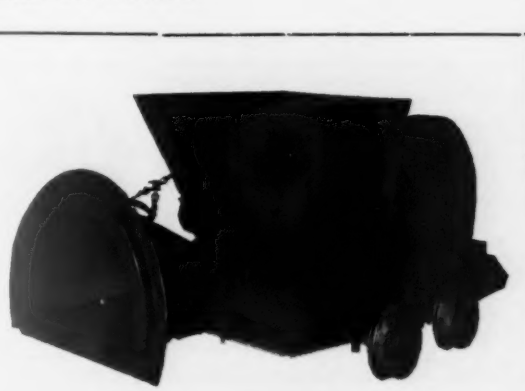

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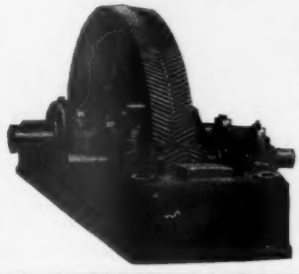

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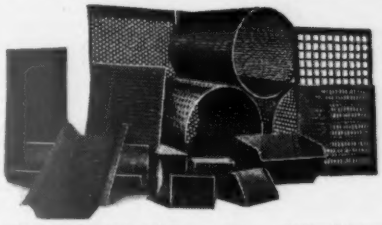

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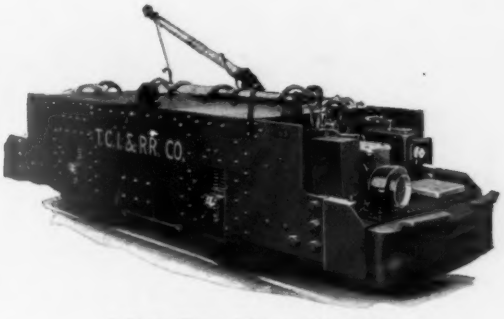

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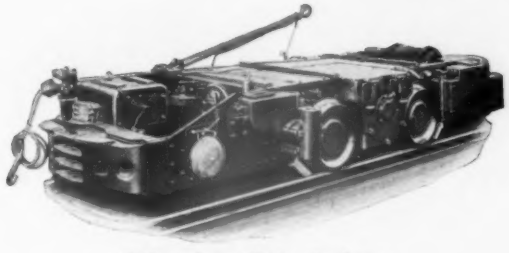

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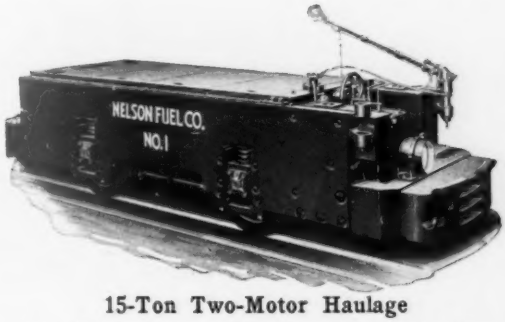

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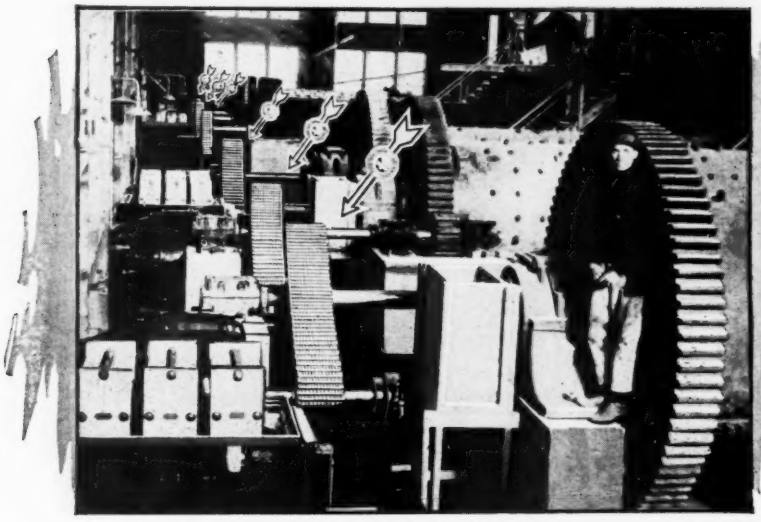

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